

LASER WELDING AND SURFACE ENGINEERING OF ADVANCED MATERIALS

SUDAREA ȘI PRELUCRAREA CU LASER A MATERIALELOR AVANSATE

Teză de abilitare

Domeniul de abilitare: Ingineria și managementul producției

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din Brașov

FACULTATEA DE ȘTIINȚA
ȘI INGINERIA MATERIALELOR





CUPRINS

BI – Realizări științifice

BII – Realizări profesionale

BIII - Planuri de evoluție și dezvoltare a carierei

BIV - Bibliografie





BI – Realizări ştiinţifice

- ❑ Baze teoretice şi motivare
- ❑ Procese care utilizează fasciculul LASER
 - Depunerea cu laser
 - Texturarea cu laser
 - Sudarea cu laser
- ❑ Cercetări experimentale privind sudarea cu laser
 - Sudarea otelurilor inoxidabile
 - Sudarea cu laser a materialelor eterogene
 - Sudarea cu laser a materialelor eterogene cu flux activ
- ❑ Procesarea cu laser a materialelor avansate de tipul aliaje FeCrAl
- ❑ Procesarea cu laser a materialelor in mediu lichid





Baze teoretice și motivare



Articole relevante cu privire la aplicațiile laser. Publicate până în 05.11.2023





Baze teoretice și motivare

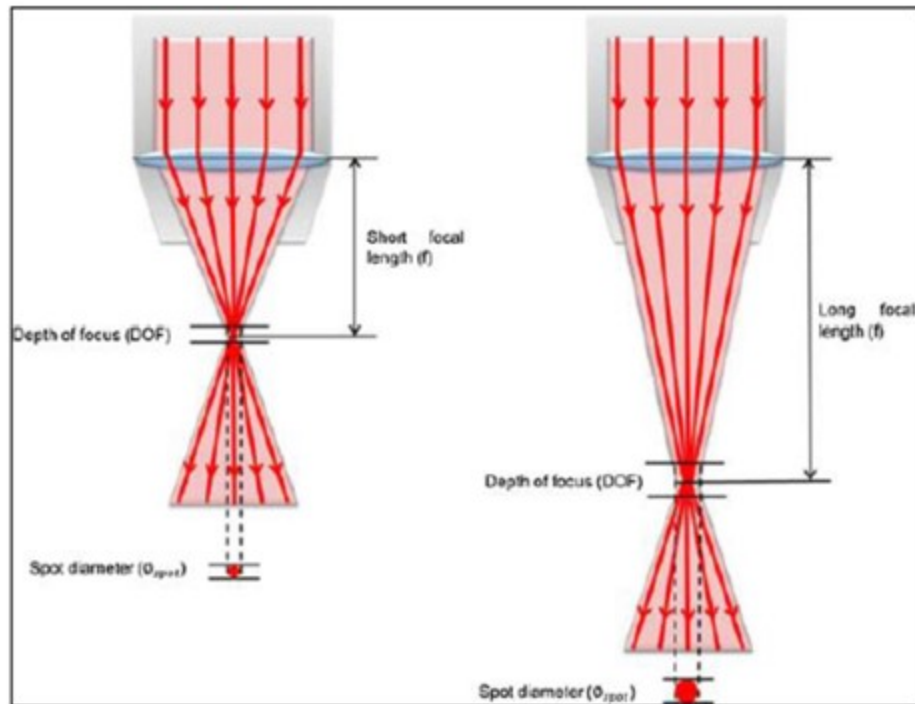
Bazele tehnologiei LASER

| Prop. Fasciculului laser | Tratamente termice | Sudare | Prelucrarea găurilor | Tăiere | Holografie | Măsurători | Aliere | Electronică | |
|--------------------------|---|--------|----------------------|--------|----------------------------|------------|--------|-------------|----------------|
| Coerență | X | X | X | X | X | | | X | |
| Direcționalitate | X | X | X | X | | X | | X | |
| Intensitate mare | X | X | X | X | X | | | X | |
| Monocromaticitate | | | | | | X | X | X | |
| Divergență mică | X | X | X | X | X | X | X | X | |
| Eficiență | X | X | X | X | | | | | |
| Mediu activ | Rubin, Diode, Nd-YAG, CO ₂ – N ₂ – He | | | | He-Ne-Argon, Rubin, Nd-YAG | | He-Ne | He-Ne | Argon, Kripton |

Baze teoretice şi motivare

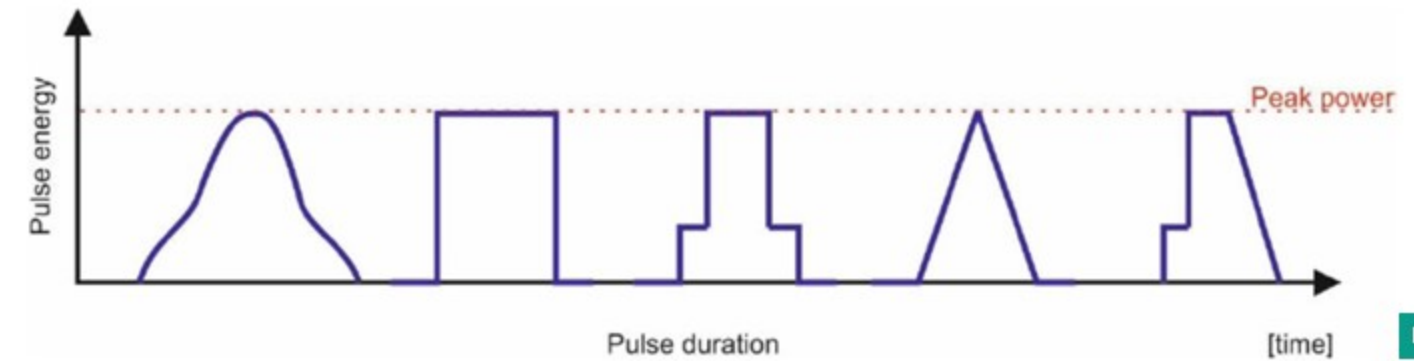
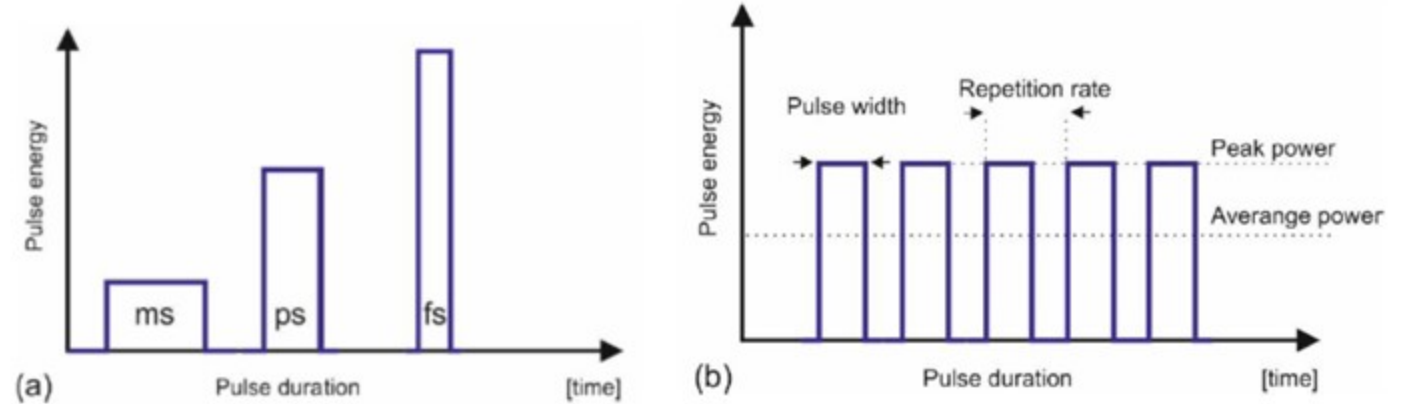
Parametrii de proces: Putere, lungimea de undă

- Distanţa focală şi lungimea de focalizare

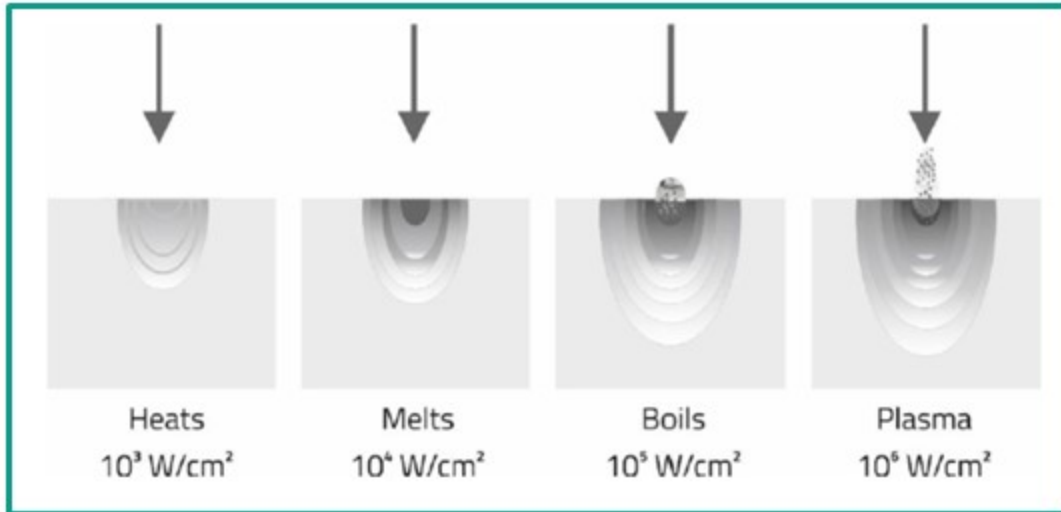


Tipul laserului: Continuu sau pulsat

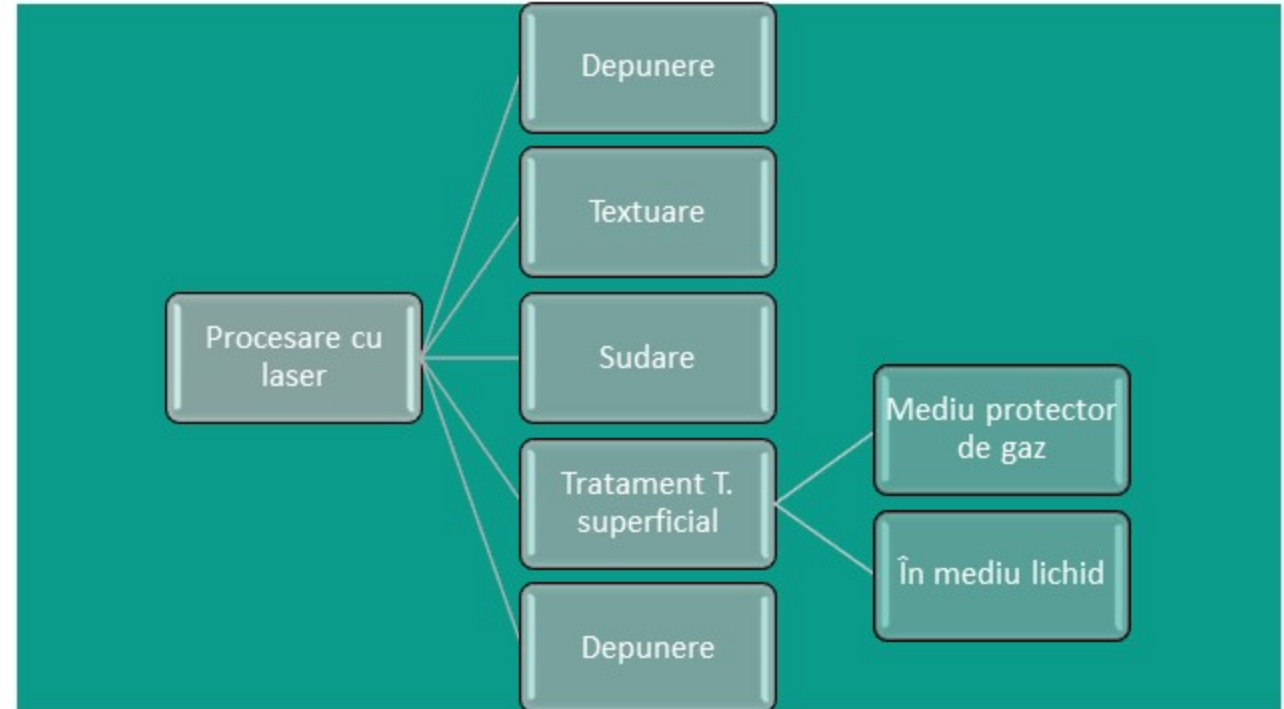
- Geometria pulsului laser



Prelucrarea cu LASER



Fenomenele care apar în timpul absorbției





Prelucrarea cu LASER



DEPUNERE CU LASER

AVANTAJE

Automatizare

Precizie ridicată

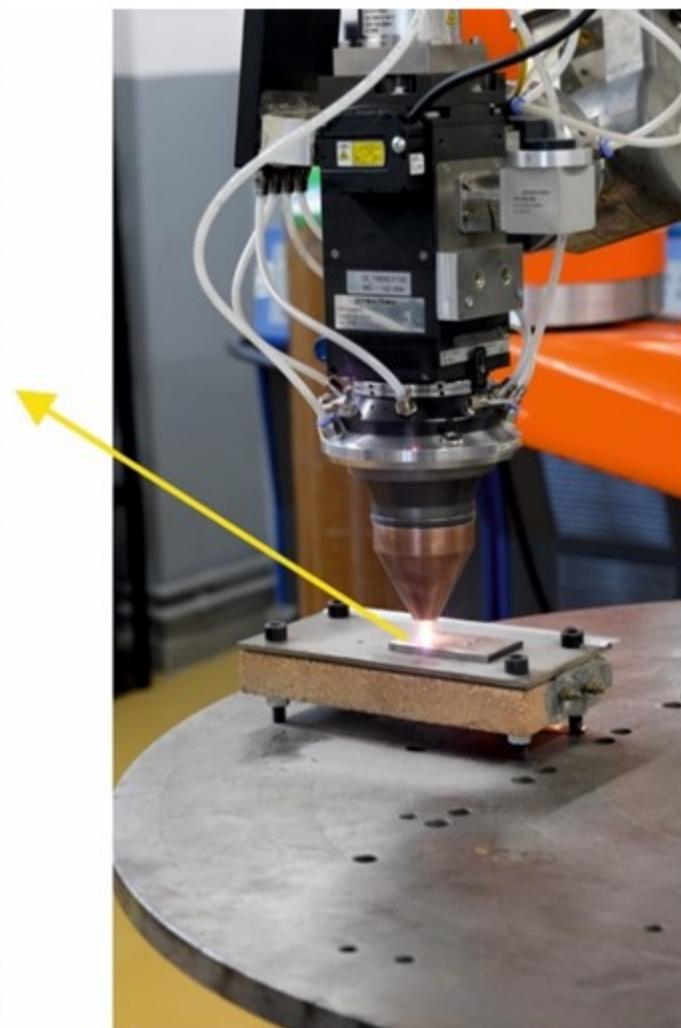
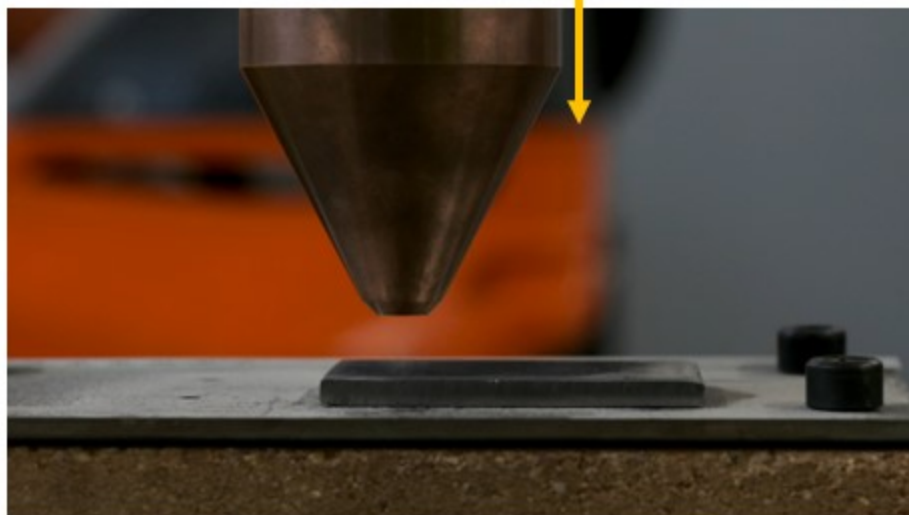
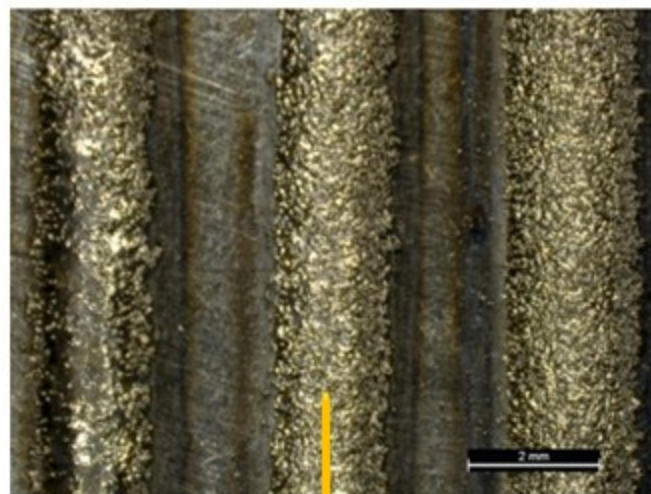
Proprietati mecanice foarte bune

Numeroase aliaje compatibile

Provocari

Set-up dificil

Susceptibilitate de fisurare



Prelucrarea cu LASER



DEPUNERE CU LASER

Parametrii principali

Puterea laserului

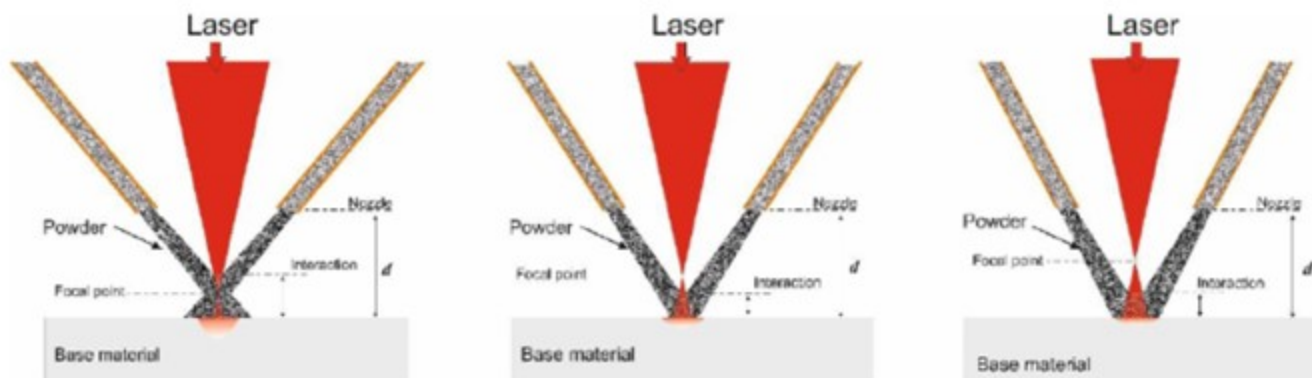
Viteza de depunere

Lungimea focala

Cantitatea de pulbere

Parametrii secundari

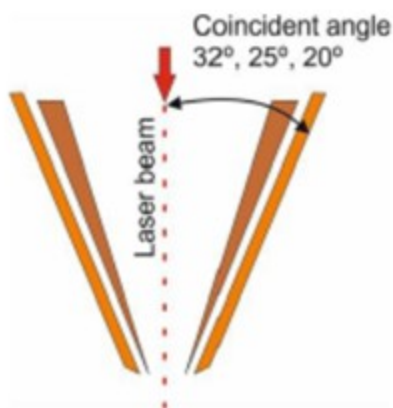
Unghiul de depunere



Nozzle Type 1

Nozzle Type 2

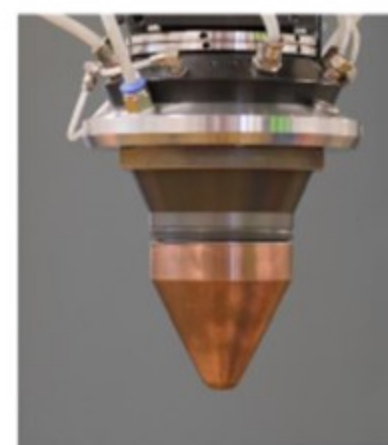
Nozzle Type 3



32 °



25 °



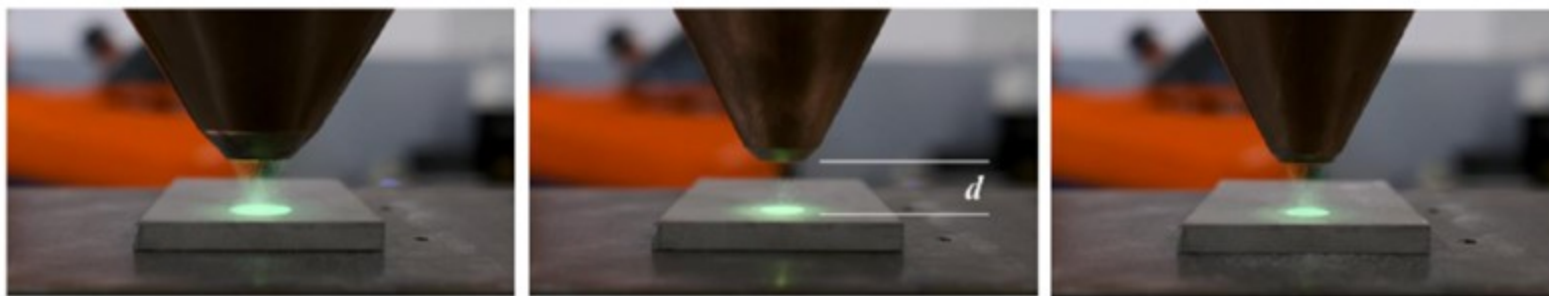
20 °



Prelucrarea cu LASER



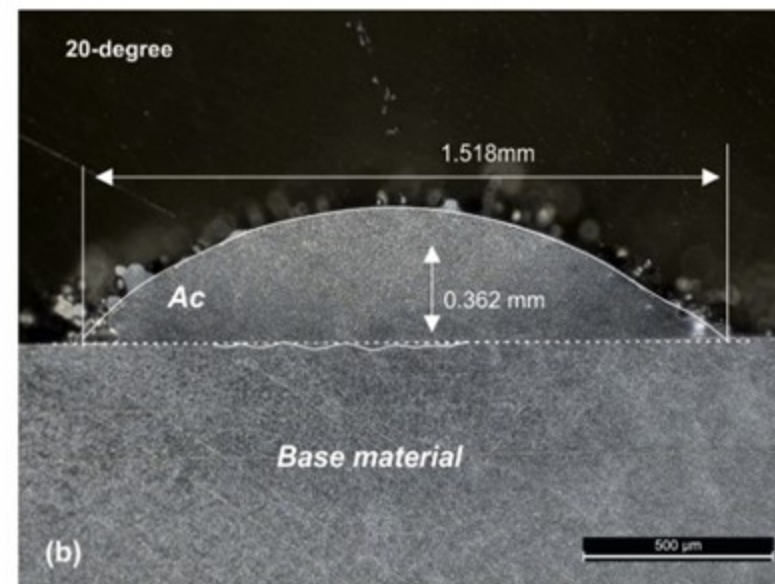
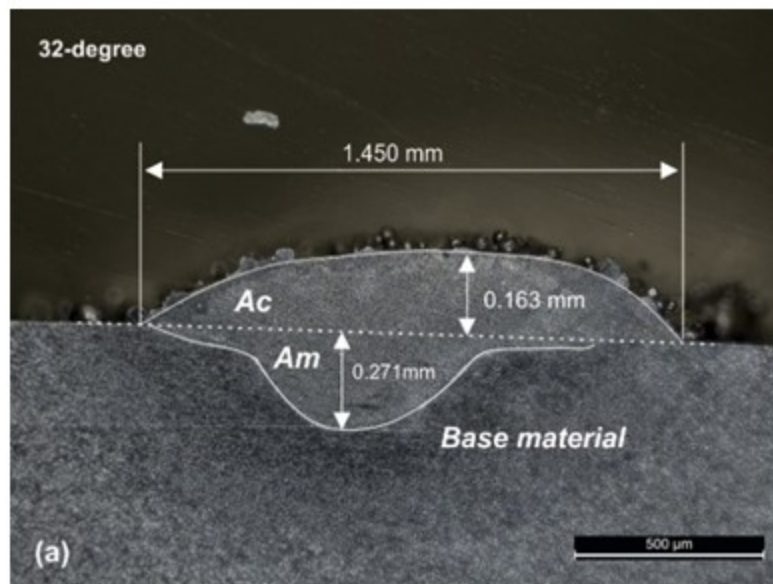
DEPUNERE CU LASER



Laser continuu Coherent 1000

Pulbere Ni₁₇Cr_{2.5}B₄Fe₄Si_{0.5}C

MB S235



Pulverizare coaxiala, Putere laser 800W, viteză de depunere 25 cm/min,

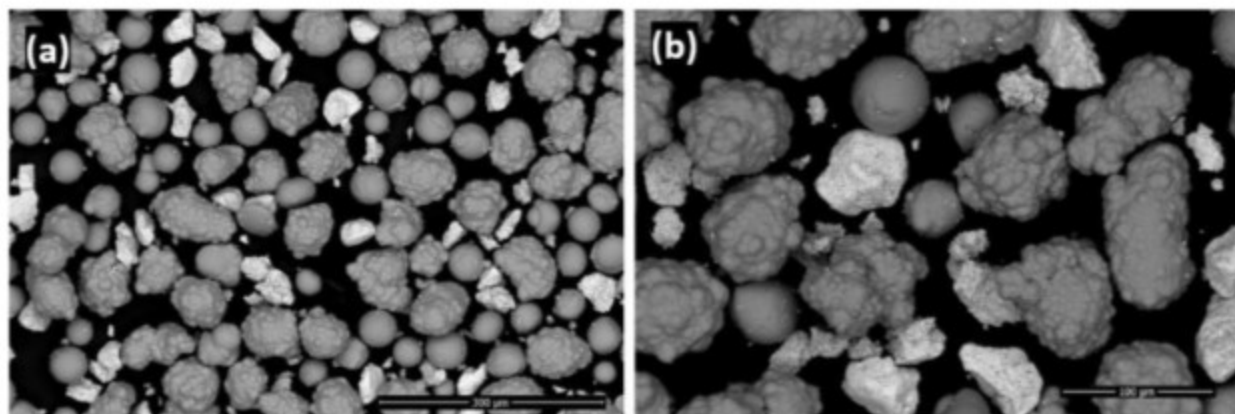
(a) 32°

(b) 20°

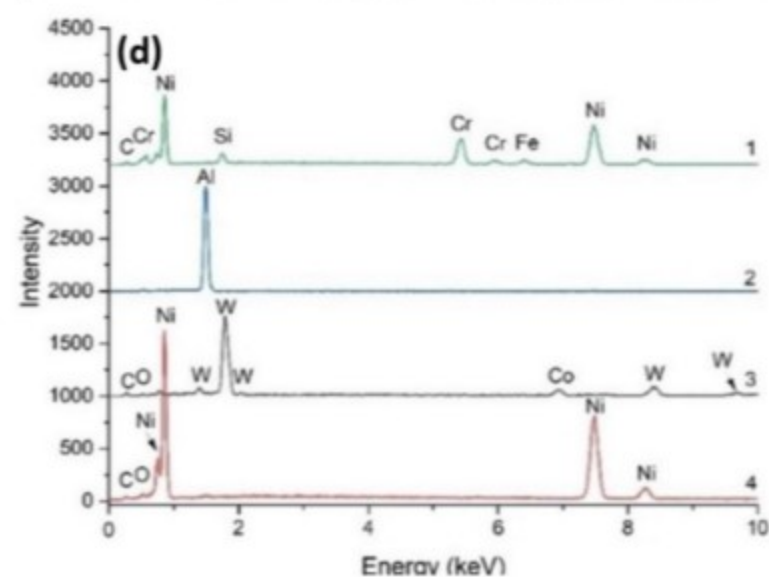
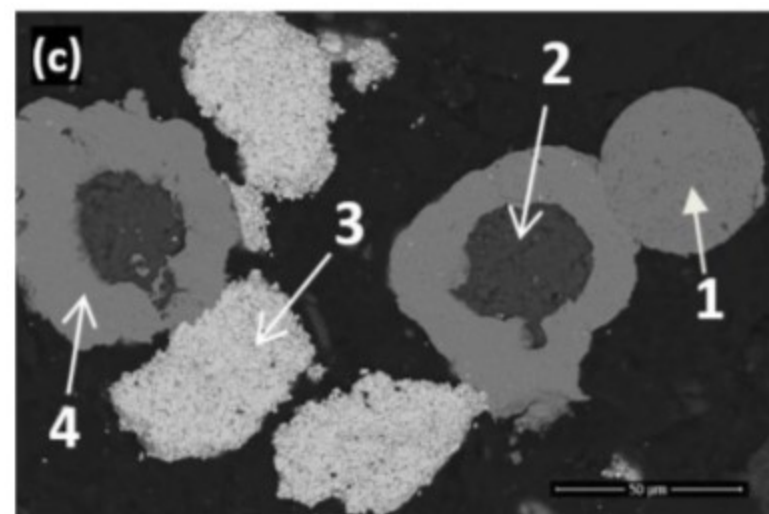


Depuneri armate cu particule dure

| Chemical composition | WC-12Co | Ni | Al | Cr | B | Fe | Si | C |
|----------------------|---------|---------|-----|-----|-----|-----|-----|-----|
| Element [%] | 50 | balance | 2.8 | 5.8 | 1.3 | 1.4 | 1.4 | 0.3 |



Analiza SEM a pulberii METCO 439 NS, a si b aspectul general al pulberii, c) secțiunea particulelor de pulbere, microanaliza compozițională a fiecărei particule





Prelucrarea cu LASER



DEPUNERE CU LASER

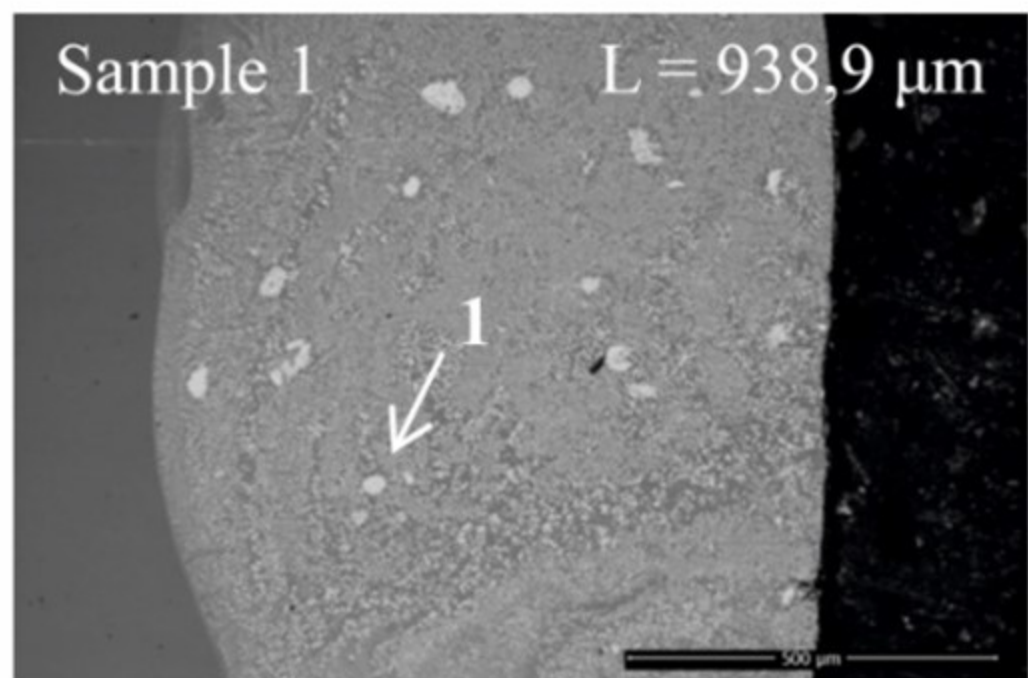
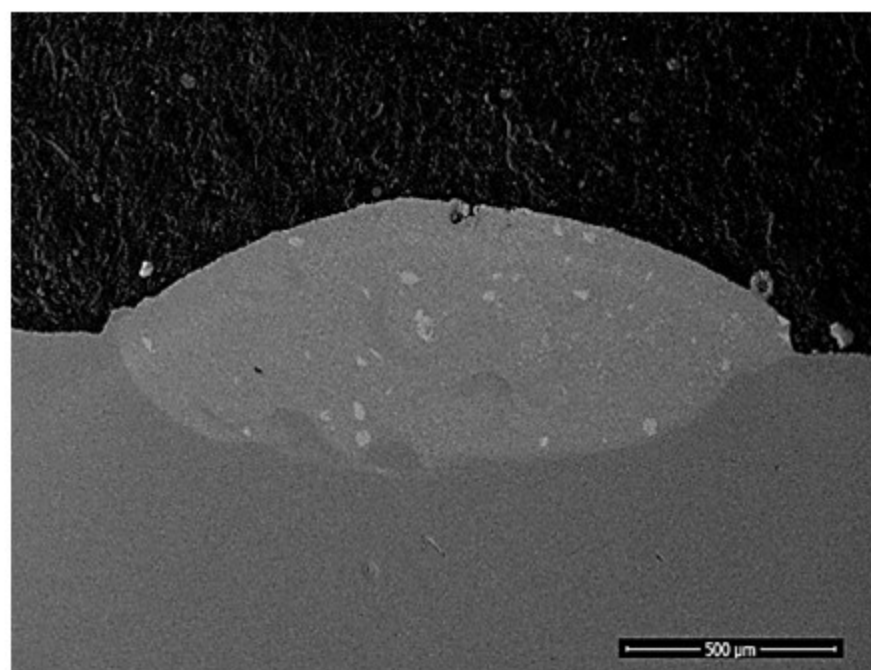
Putere: 720 W

Diametru Spot: 2.2 mm

Viteza optimă de depunere: 55 - 65 cm/min

Cantitate de pulbere: 4g/min

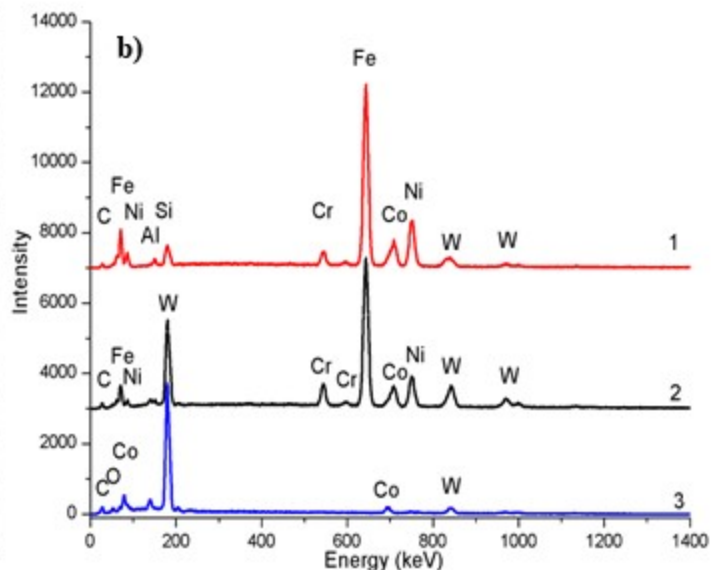
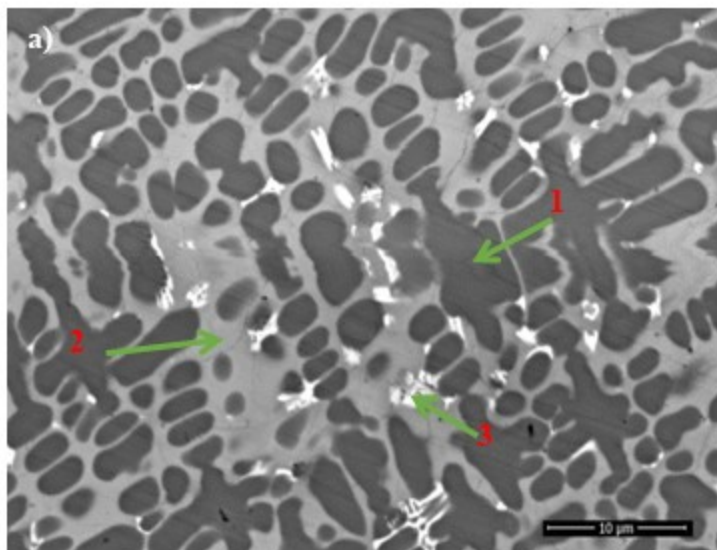
T preîncălzire: 320 °C



Prelucrarea cu LASER



DEPUNERE CU LASER



Putere: 720 W

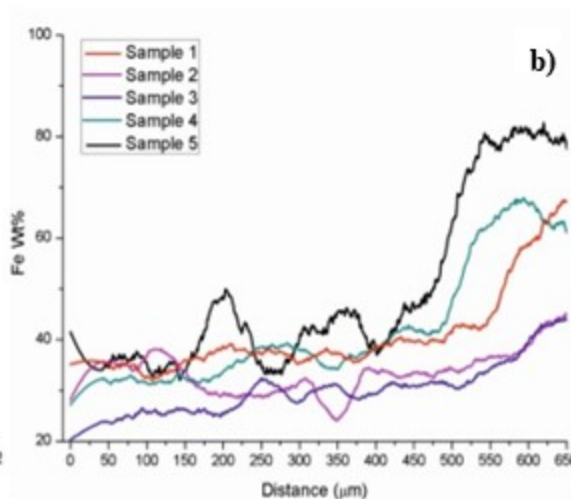
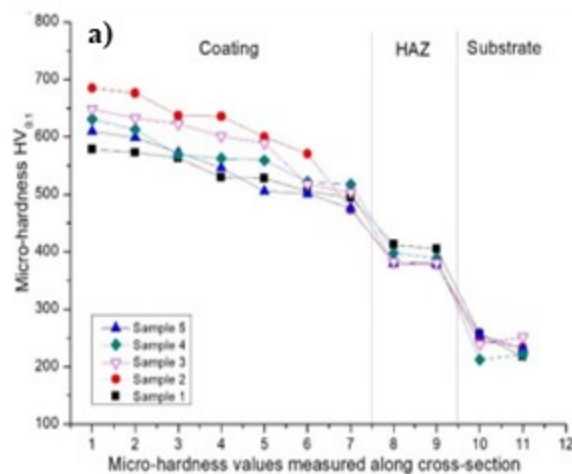
Diametru Spot: 2.2 mm

Viteza optimă de depunere: 55 - 65 cm/min

Cantitate de pulbere: 4g/min

T preîncălzire: 320 °C

Microstructura probei nr. 4 și analiza EDS în punctele
1, 2 și 3



Microdurețea stratului depus (a) și conținutul de Fe

Prelucrarea cu LASER

TEXTURARE CU LASER

MICRO TEXTURARE CU LASER

Material AISI 430

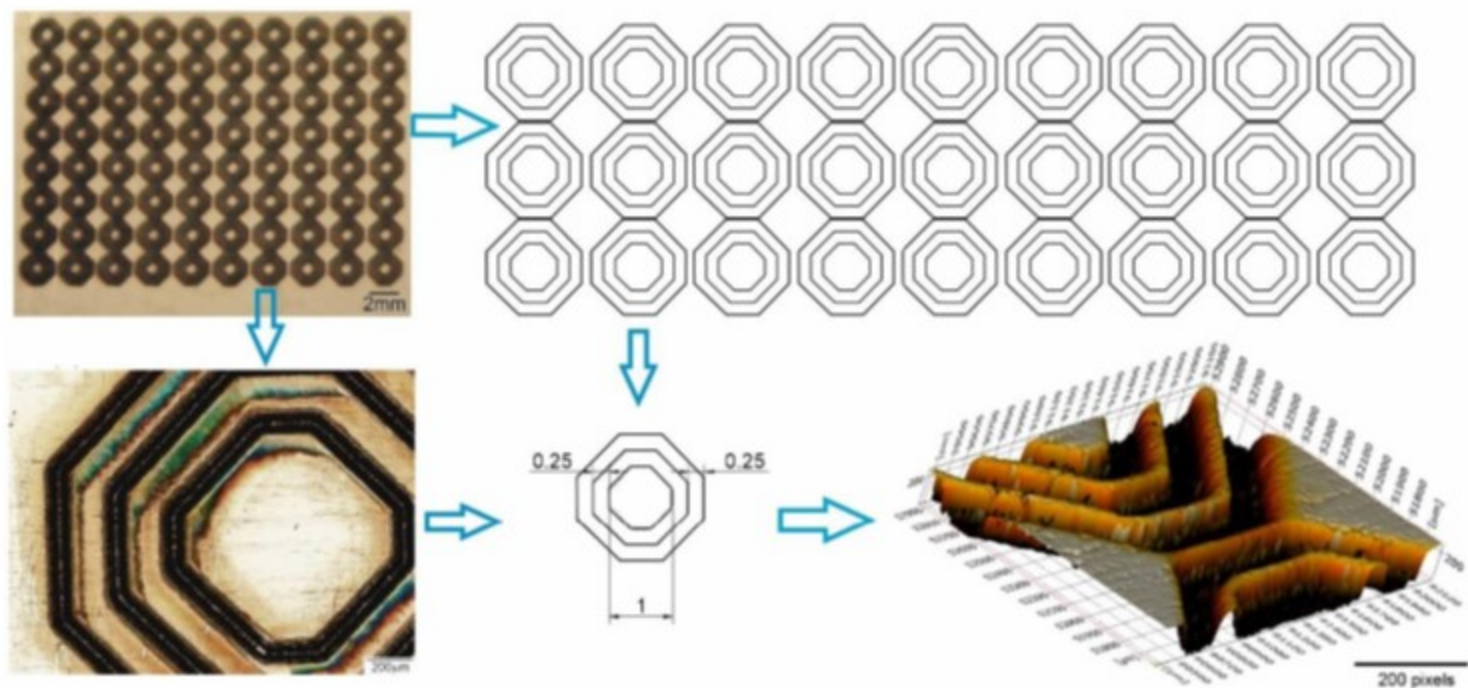
LASER: Fibră

Parametrii: durata puls în domeniul nanosecundelor

Frecvență: pana la 1000 kz

Avantaje

Proprietăți tribologice
superioare
Fără ZIT



Prelucrarea cu LASER



TEXTURARE CU LASER

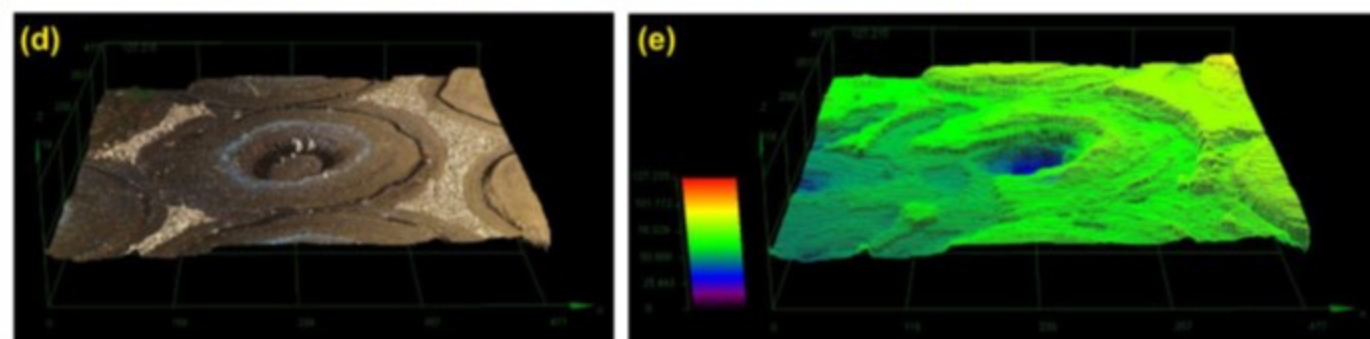
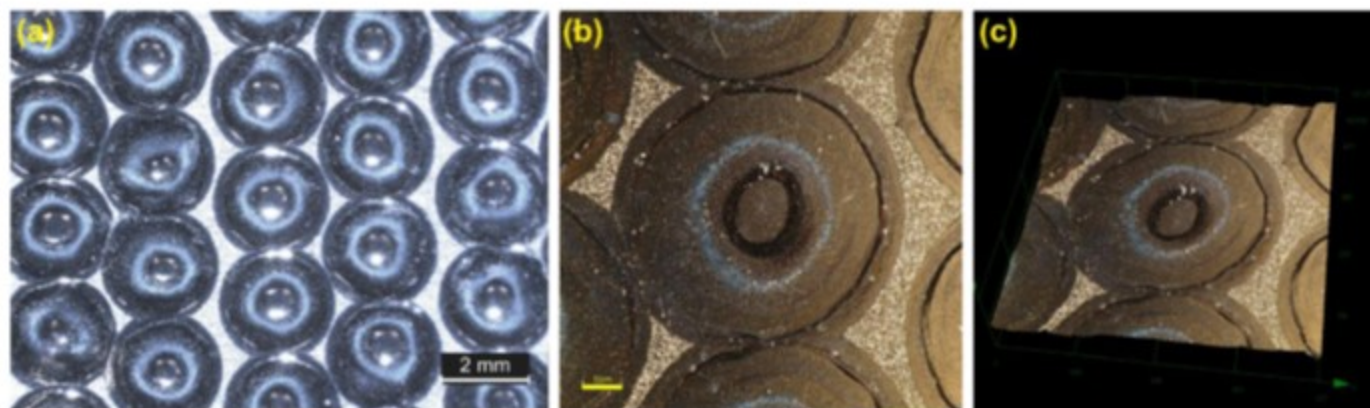
MACRO TEXTURARE CU LASER

Material AISI 316

LASER: Nd: YAG pulsat

Parametrii: durata puls în domeniul milisecundelor

Frecvență: pana la 100 Hz



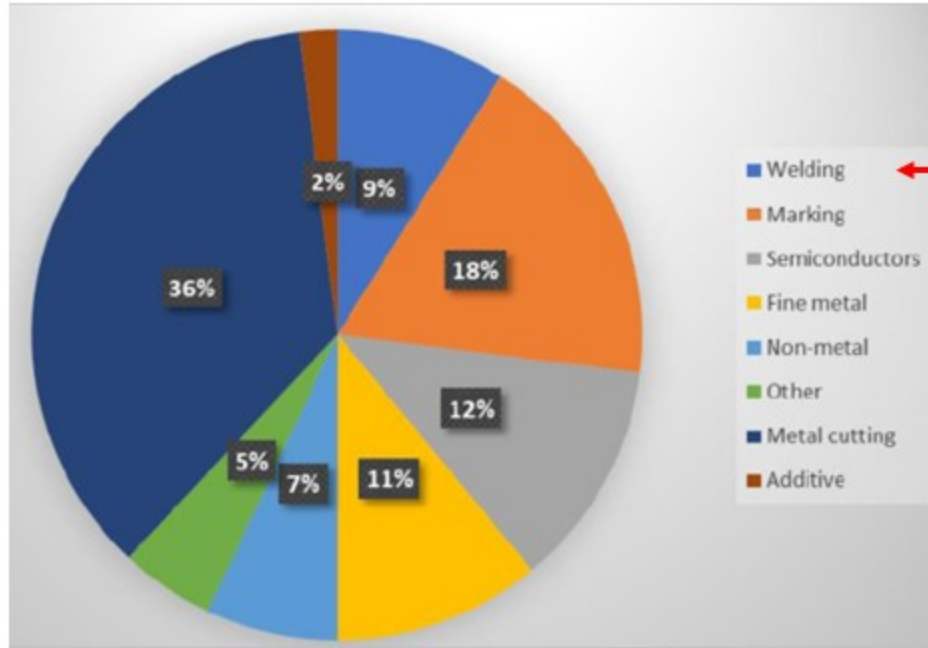
Avantaje

Proprietăți tribologice superioare
ZIT redus

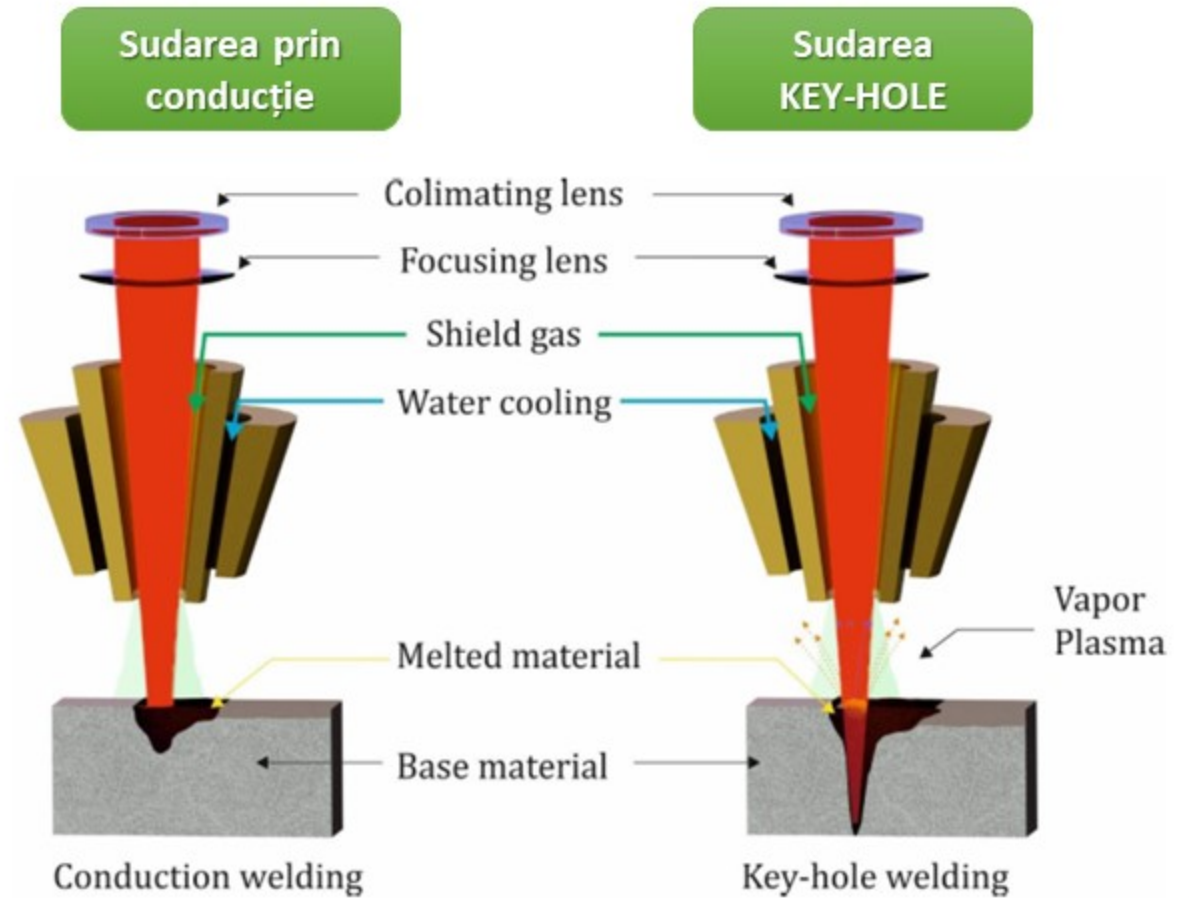
Aplicații:
Creșterea aderenței suprafeței

Prelucrarea cu LASER

SUDAREA CU LASER



Utilizarea laserilor în industrie în 2020





| Material | Element wt. (%) | | | | | | | | |
|-----------|-----------------|------|------|-------|-------|-------|-------|------|------|
| | C % | Si % | Mn % | P % | S % | Cr % | Ni % | Mo % | N % |
| AISI 316L | 0.03 | 0.75 | 2 | 0.004 | 0.003 | 16-18 | 10-14 | 2-3 | 0.10 |

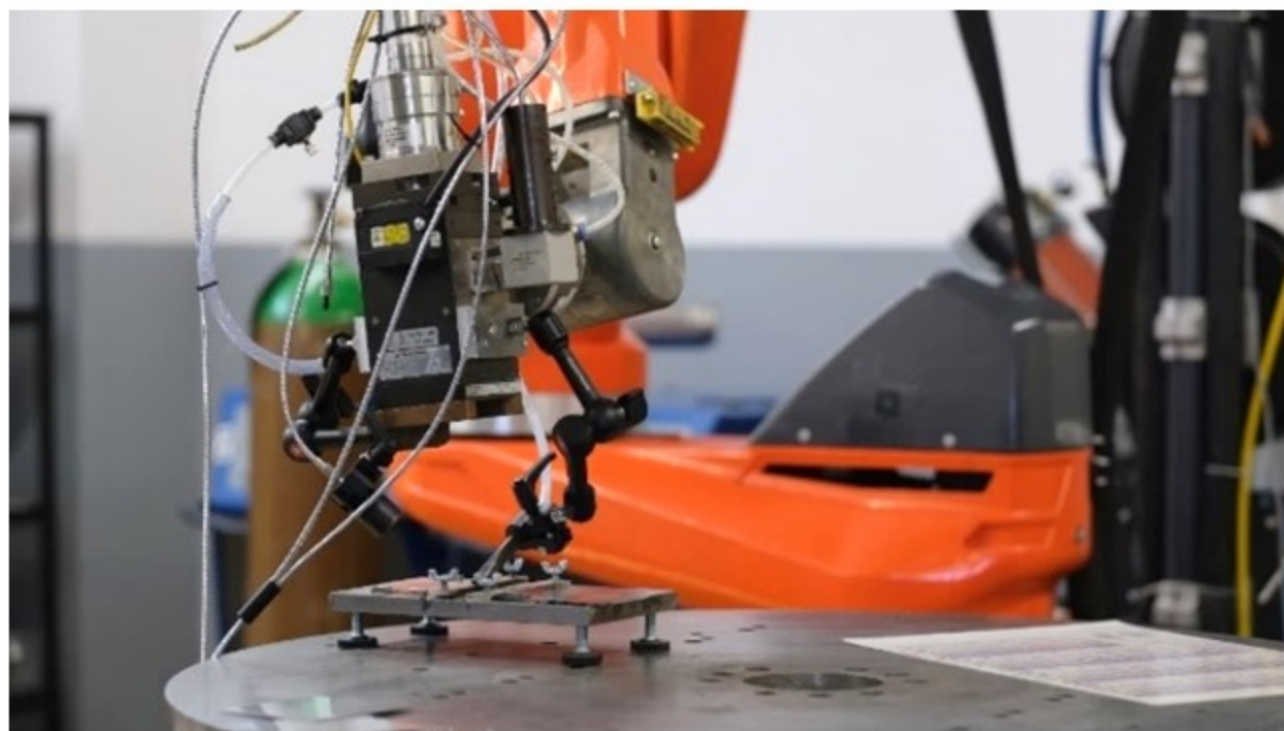
LASER TRUPULSE

Lungime de undă: 1064 nm

Putere max. 10 kW

Durata puls: 0.2 – 50 ms

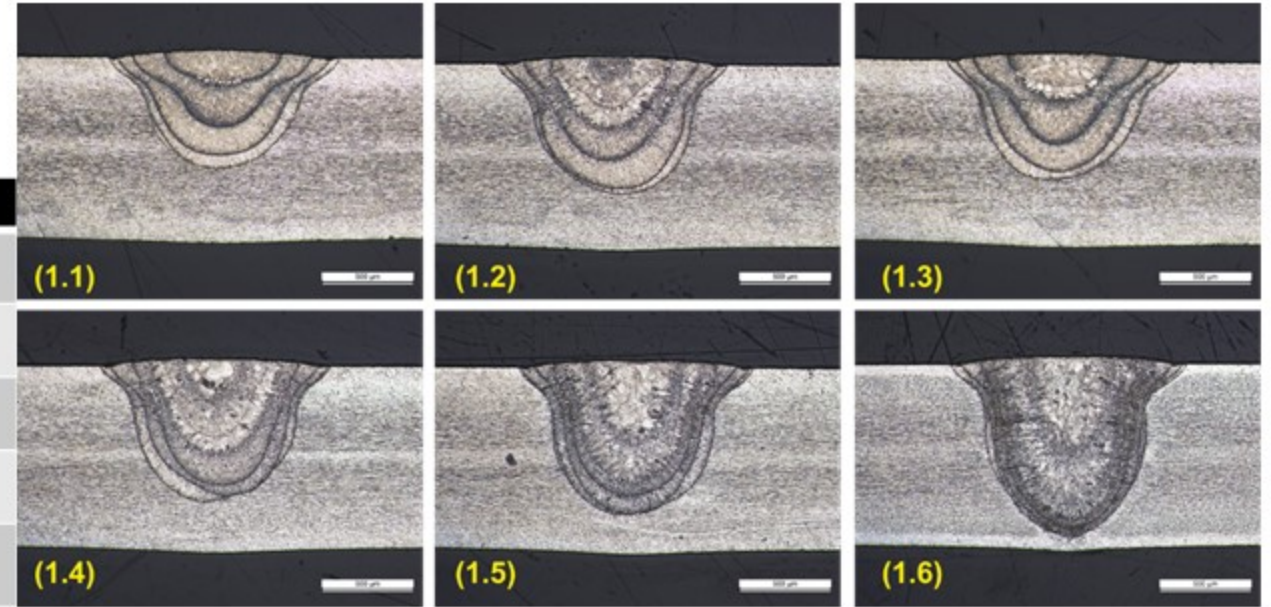
Frecvență: - 900 Hz



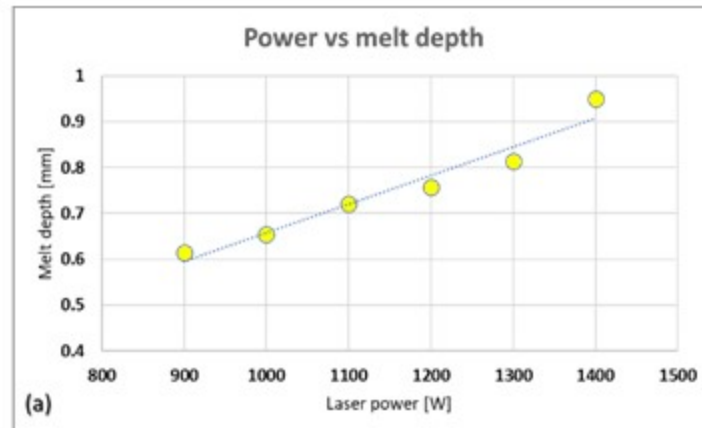


Influența puterii asupra profilului zonei topite

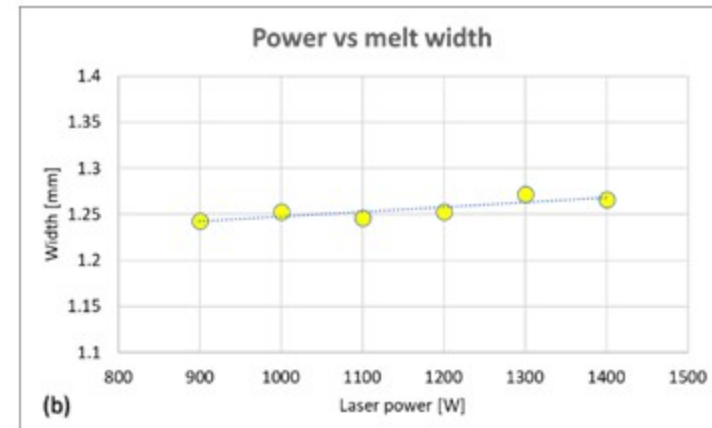
| Parametrii / probă | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 |
|---------------------------|-----|------|------|------|------|------|
| Putere laser [w] | 900 | 1000 | 1100 | 1200 | 1300 | 1400 |
| Durață puls [ms] | 7 | 7 | 7 | 7 | 7 | 7 |
| Frecvența [Hz] | 40 | 40 | 40 | 40 | 40 | 40 |
| Densitatea de putere [J] | 6.3 | 7 | 7.7 | 8.4 | 9.1 | 9.8 |
| Viteza de sudare [cm/min] | 45 | 45 | 45 | 45 | 45 | 45 |



Adâncimea de topire



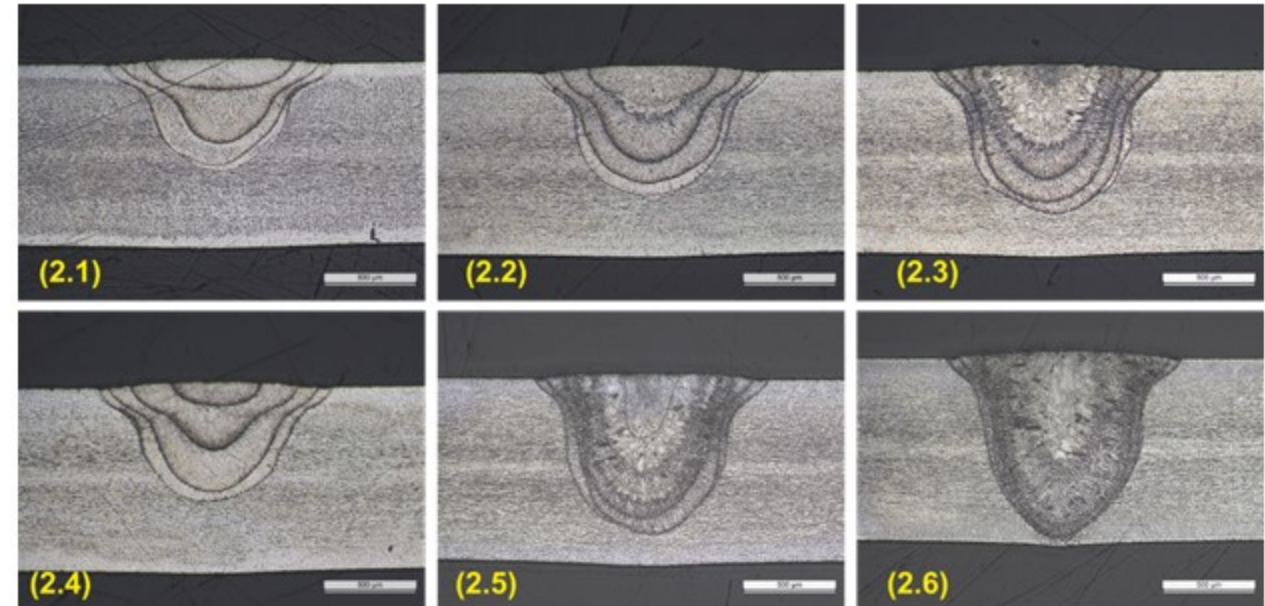
Lățimea



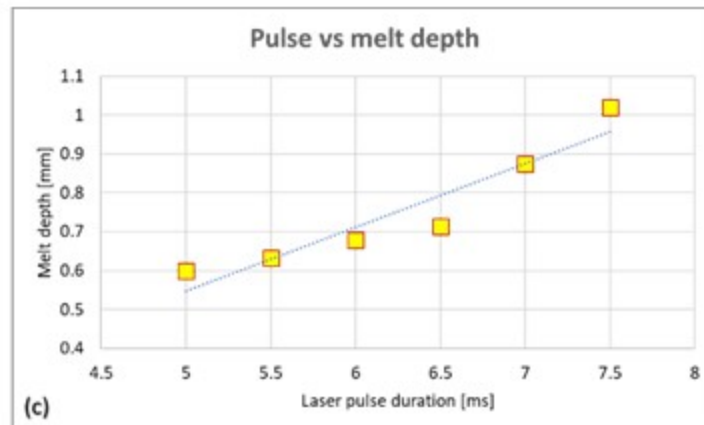


Influența duratei pulsului asupra profilului zonei topite

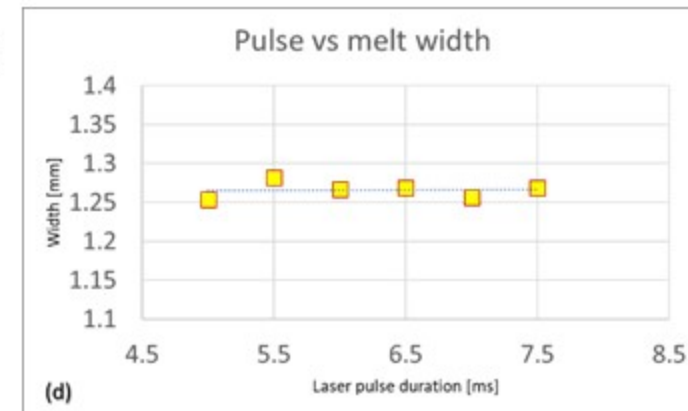
| Parametrii / probă | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 |
|---------------------------|------|------|------|------|------|------|
| Putere laser [w] | 1300 | 1300 | 1300 | 1300 | 1300 | 1300 |
| Durată puls [ms] | 5 | 5.5 | 6 | 6.5 | 7 | 7,5 |
| Frecvența [Hz] | 40 | 40 | 40 | 40 | 40 | 40 |
| Densitatea de putere [J] | 6.5 | 7.1 | 7.8 | 8.3 | 9.1 | 9.8 |
| Viteza de sudare [cm/min] | 45 | 45 | 45 | 45 | 45 | 45 |



Adâncimea de topire



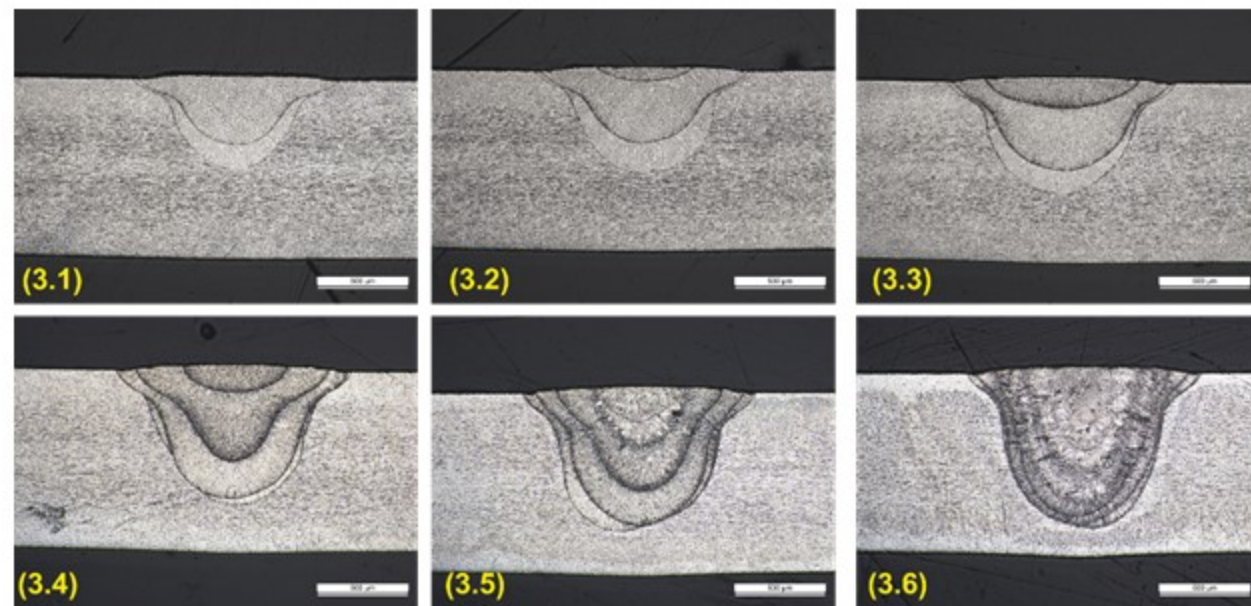
Lățimea



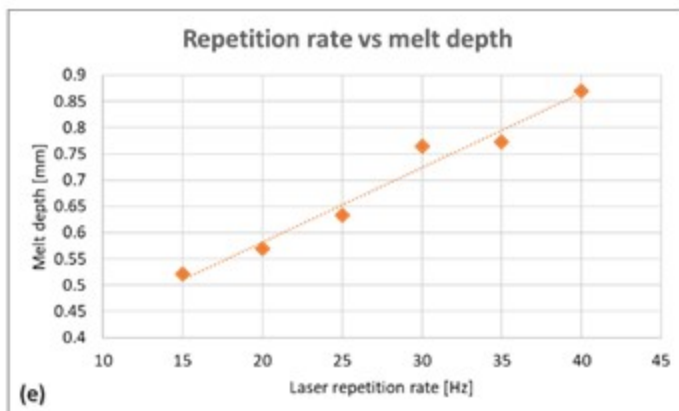


Influența frecvenței asupra profilului zonei topite

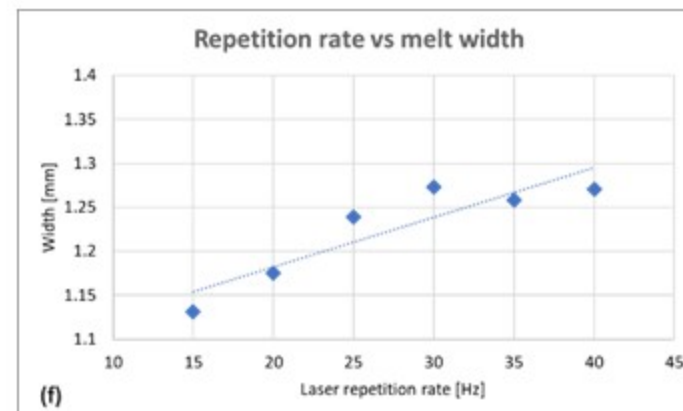
| Parametrii / probă | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 |
|---------------------------|------|------|------|------|------|------|
| Putere laser [w] | 1300 | 1300 | 1300 | 1300 | 1300 | 1300 |
| Durață puls [ms] | 7 | 7 | 7 | 7 | 7 | 7 |
| Frecvența [Hz] | 15 | 20 | 25 | 30 | 35 | 40 |
| Densitatea de putere [J] | 9.1 | 9.1 | 9.1 | 9.1 | 9.1 | 9.1 |
| Viteza de sudare [cm/min] | 45 | 45 | 45 | 45 | 45 | 45 |



Adâncimea de topire



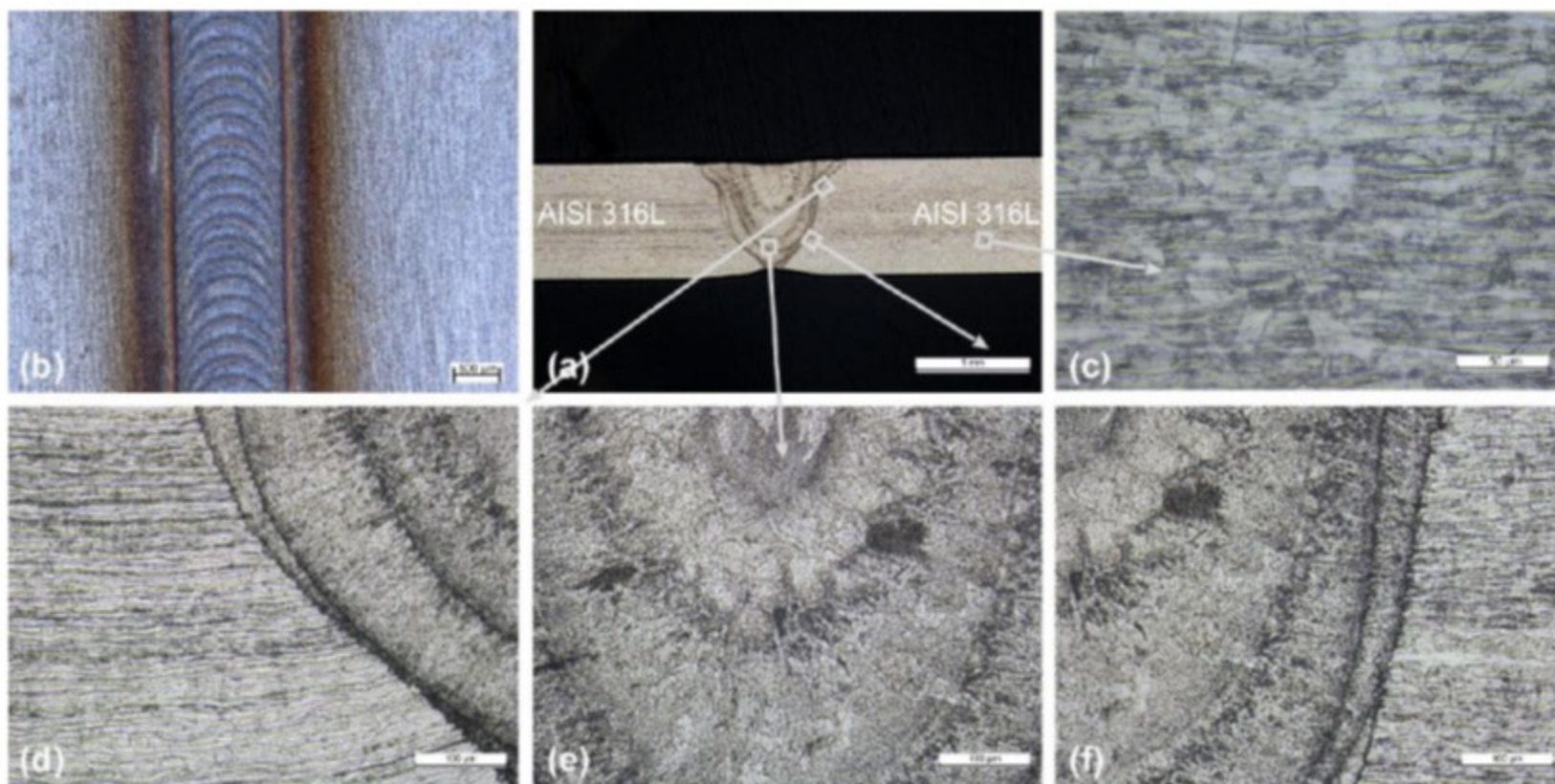
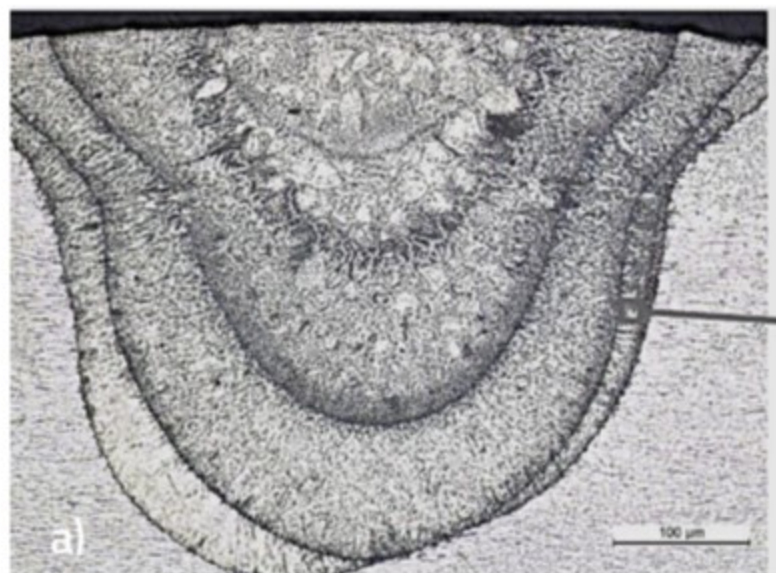
Lățimea





Parametrii optimi ai procesului de sudare cu laser

Puterea laserului 1300 W
Diametrul Spotului 0.8 mm
Distanţa focală 150mm
Durata pulsului 7ms
Frecvenţa pulsurilor 40 Hz
Viteza de procesare 45 cm/min
Gaz de protecţie Ar | 18 l/min



Îmbinare cap la cap
Material AISI 316 L, grosime 1 mm





| Material | Element wt. (%) | | | | | | | | |
|-----------|-----------------|-------|------|------------|------------|-------|-------|------------|------|
| | C % | Si % | Mn % | P % | S % | Cr % | Ni % | Mo % | Ti % |
| AISI 1010 | 0.099 | 0.168 | 0.51 | 0.003 3 | 0.006 9 | 0.043 | 0.041 | 0.002 4 | - |
| AISI 321 | 0.08 | 1 | 2 | 0.045 | 0.03 | 18 | 11 | - | 0.15 |

Laser continuu Coherent F1000

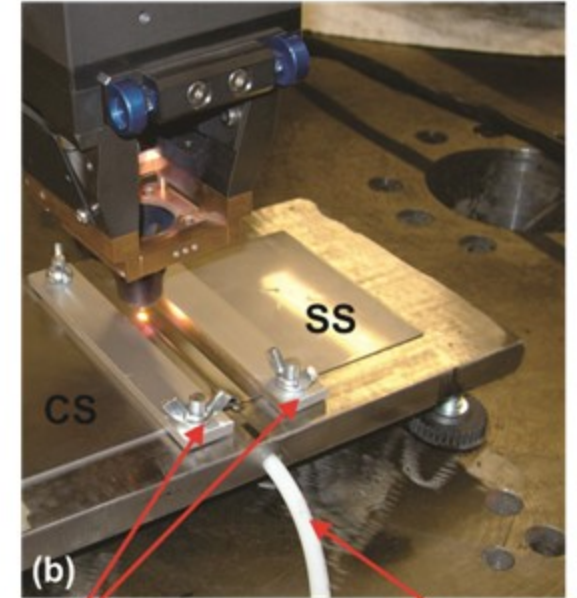
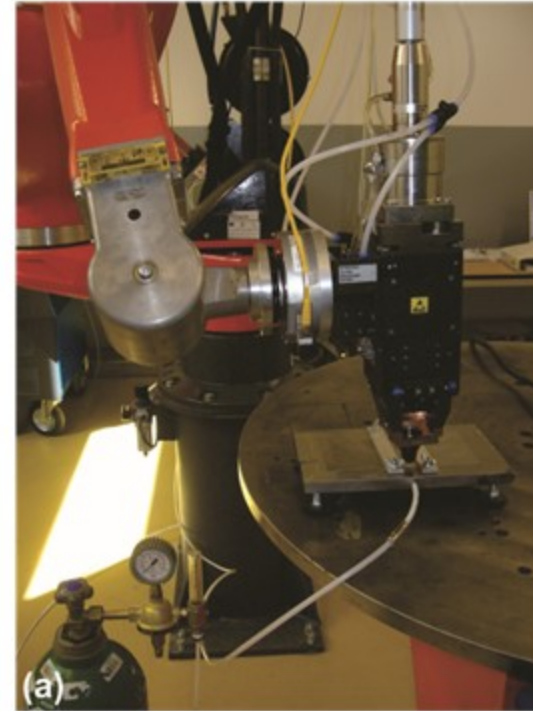
Puterea laserului max. 1000 W

Lungimea de undă 975 nm

Diametrul Spotului 0.9 mm

Distanţa focală 150mm

Gaz de protecţie Ar



Cadru experimental pentru sudarea materialelor eterogene





Cercetări experimentale

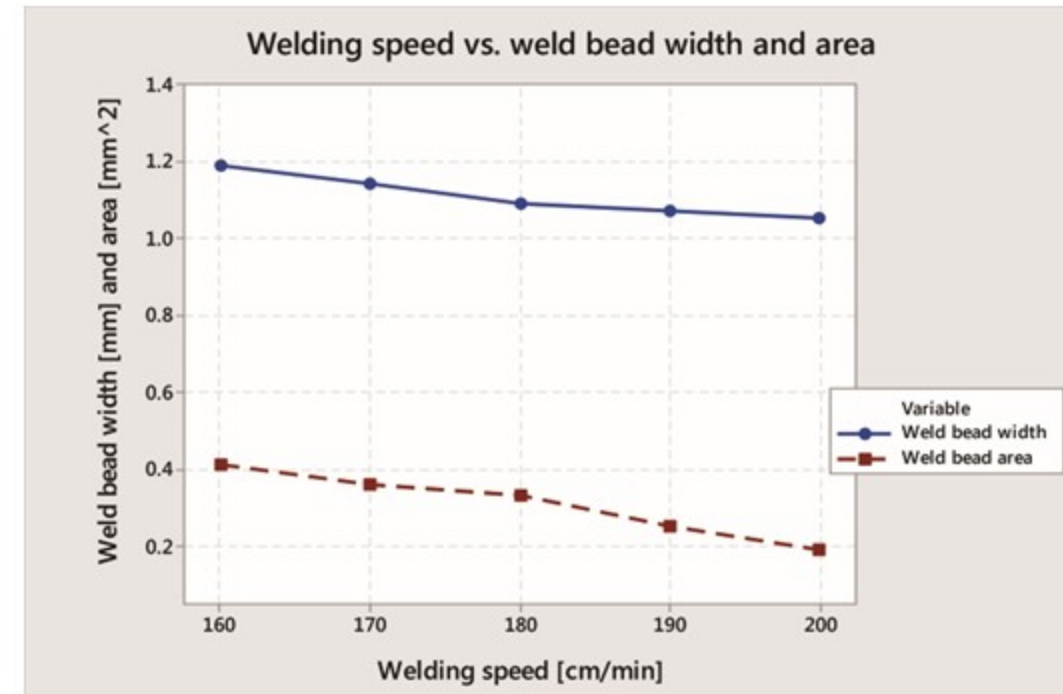
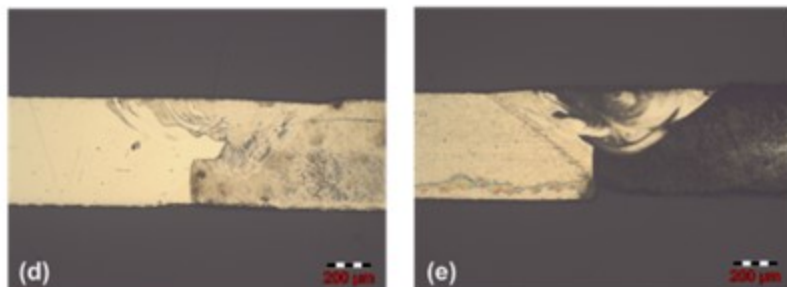
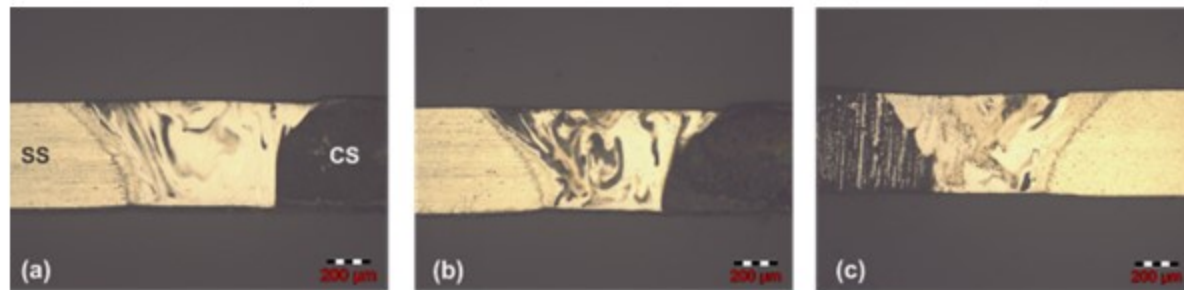


Sudarea cu laser a materialelor eterogene

AISI 1010 – AISI 321

| Parametrii | Probă | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 |
|-----------------------|-----------------------|--------------|--------------|--------------|-----------|-----------|
| Putere laer | [W] | 550 | 550 | 550 | 550 | 550 |
| Densitate de putere | [kW/cm ²] | 143 | 143 | 143 | 143 | 143 |
| Densitatea de energie | [J/mm ²] | 29.4 | 27.7 | 26.2 | 24.8 | 23.5 |
| Viteza de sudare | [cm/min] | 160 | 170 | 180 | 190 | 200 |
| Pătrunderea | [mm] | 0.51 | 0.50 | 0.51 | 0.37 | 0.30 |
| Lăţimea | [mm] | 1.19 0.69 | 1.14 0.54 | 1.09 0.47 | 1.07 - | 1.05 - |
| Aria cusăturii | [mm ²] | 0.41 | 0.36 | 0.33 | 0.25 | 0.19 |

Grosime material : 0.5 mm



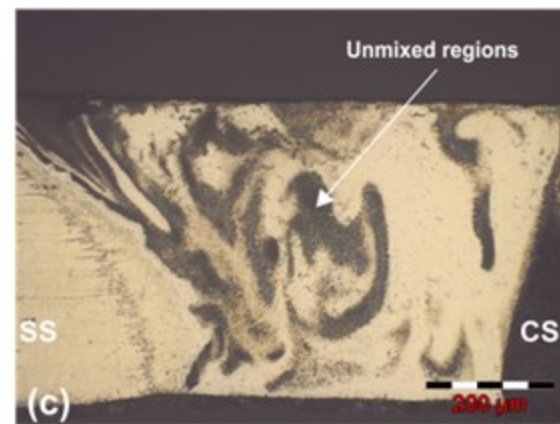
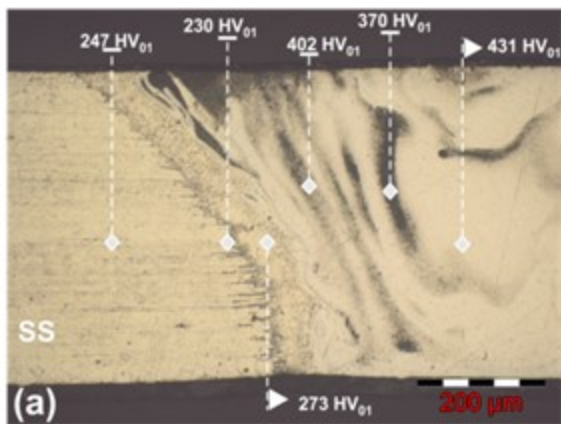


Cercetări experimentale

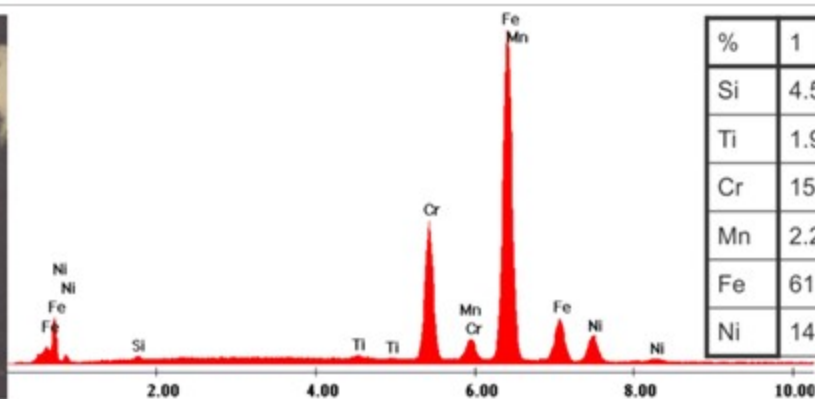


Sudarea cu laser a materialelor eterogene

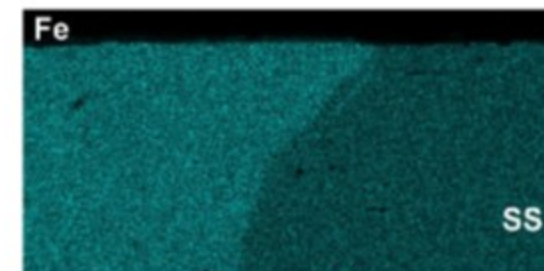
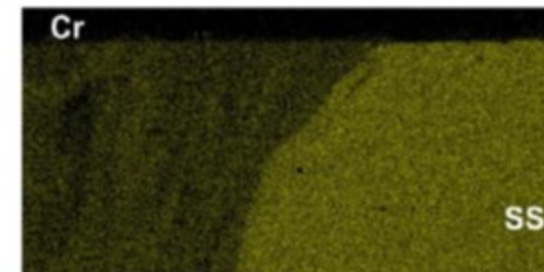
AISI 1010 – AISI 321



Distribuția micro duriții în
cordonul sudat



| % | 1 | 2 | 3 | 4 | 5 | 6 |
|----|------|------|------|------|------|------|
| Si | 4.5 | 2.0 | 2.0 | 1.1 | 1.3 | 1.3 |
| Ti | 1.9 | 0.9 | 0.8 | 1.5 | 0.4 | 0.3 |
| Cr | 15.4 | 14.3 | 13.2 | 14.1 | 10.3 | 3.5 |
| Mn | 2.24 | 2.1 | 1.5 | 2.0 | 1.6 | 0.9 |
| Fe | 61.9 | 69.1 | 74.2 | 72.6 | 82.2 | 91.6 |
| Ni | 14.1 | 11.6 | 8.3 | 8.6 | 6.2 | 2.4 |



Distribuția compoziției chimice în cordonul sudat

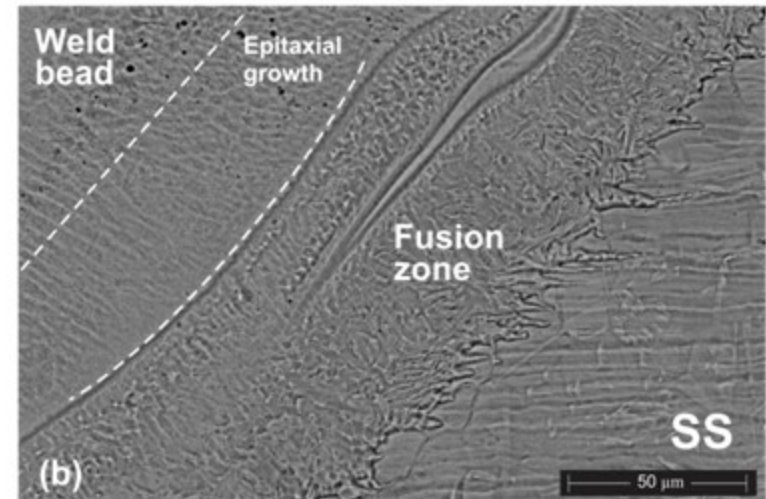
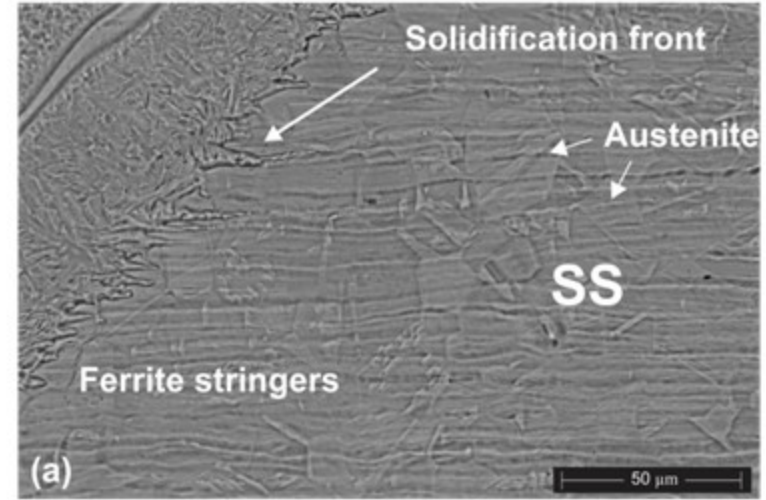
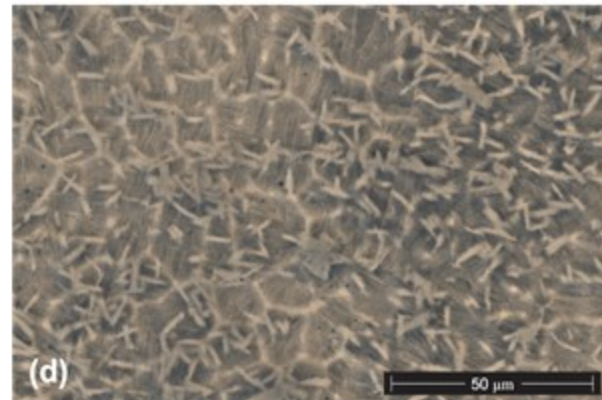
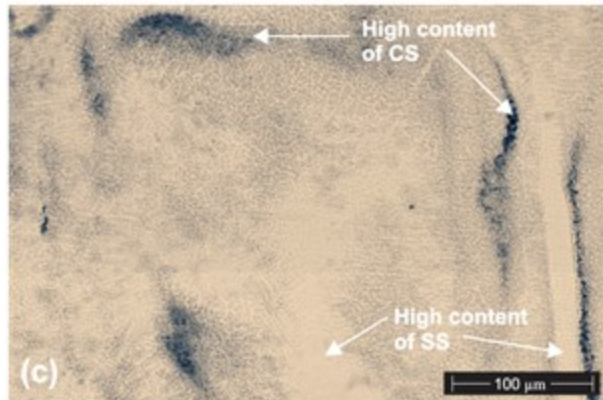
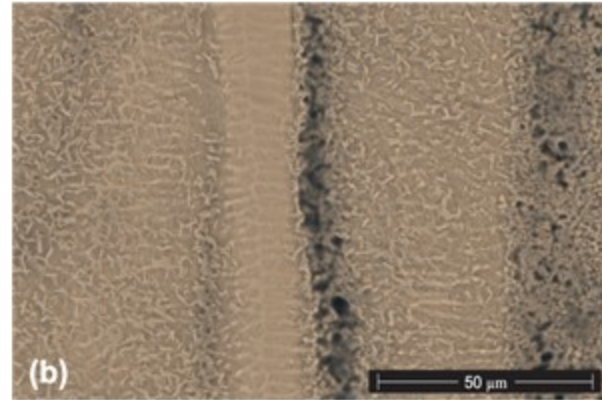
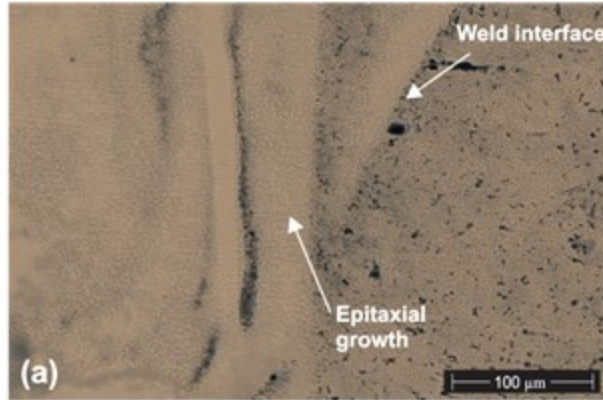


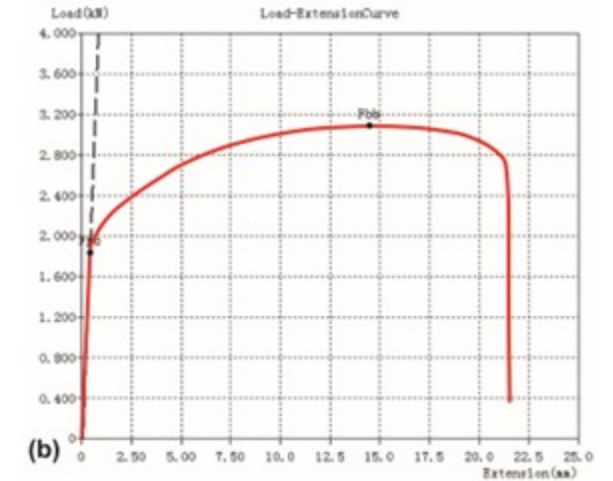
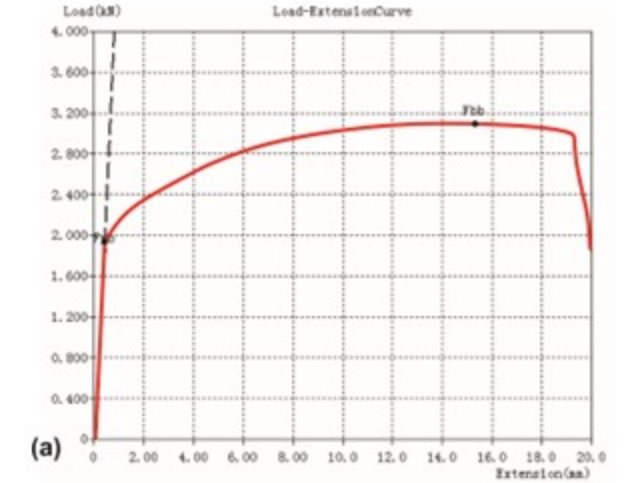
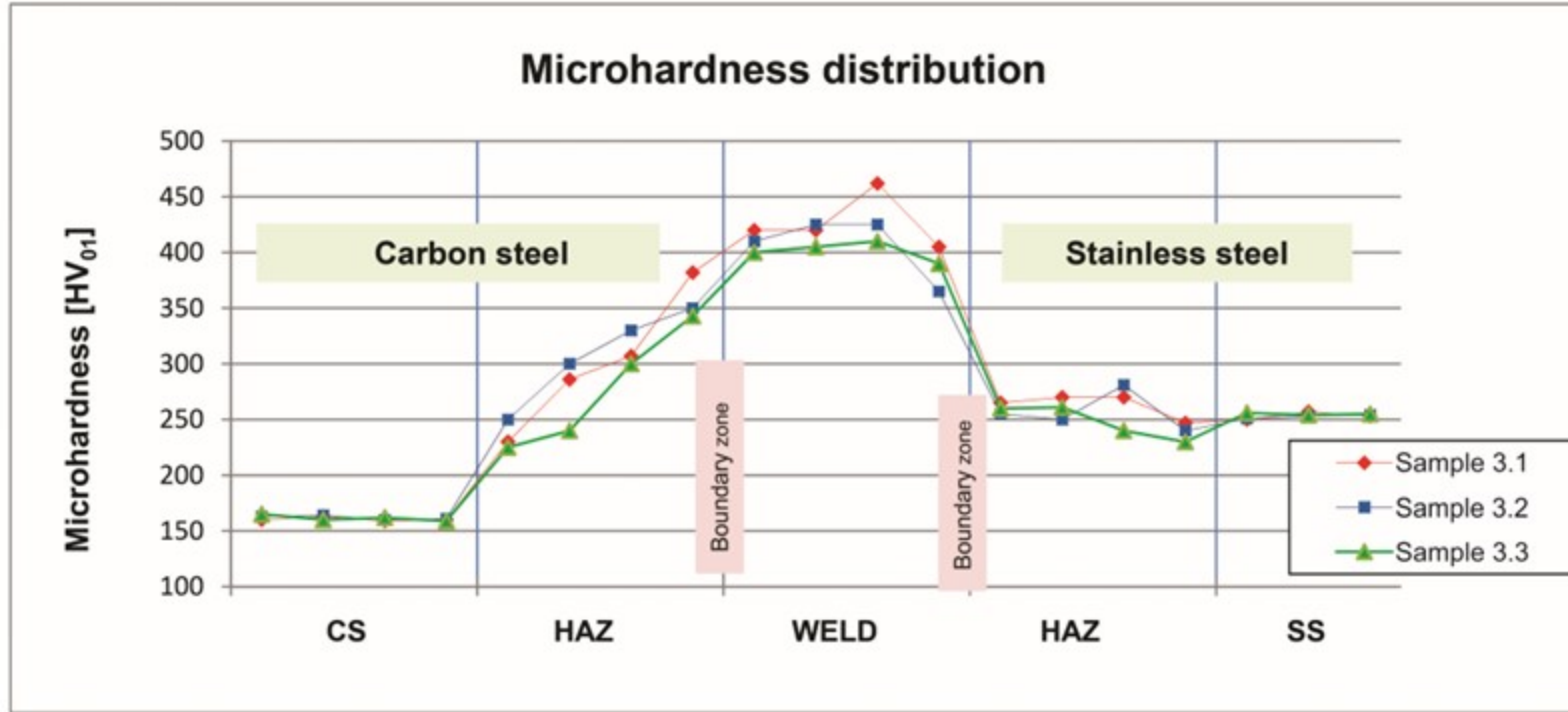
Cercetări experimentale



Sudarea cu laser a materialelor eterogene

AISI 1010 – AISI 321





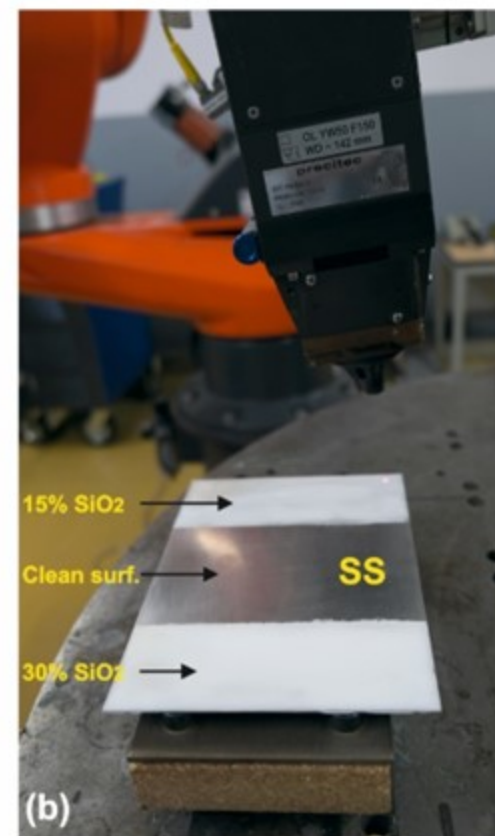
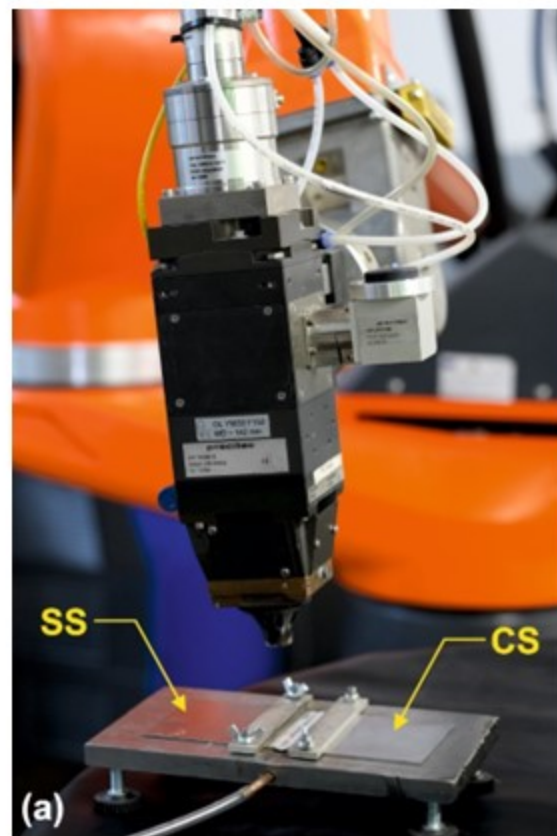
Analiza micro durtăţii în cordonul sudat şi a rezistenţei mecanice



Active flux: SiO_2 + alcool polivinilic | 15 % & 30 %

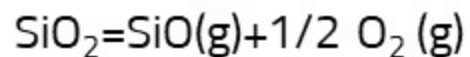
| Material | Element wt. (%) | | | | | | | | |
|----------|-----------------|-------|------|-------|-------|-------|-------|-------|------|
| | C % | Si % | Mn % | P % | S % | Cr % | Ni % | Mo % | Ti % |
| S235 | 0.099 | 0.168 | 0.51 | 0.003 | 0.006 | 0.043 | 0.041 | 0.002 | - |
| AISI 321 | 0.08 | 1 | 2 | 0.045 | 0.03 | 18 | 11 | - | 0.15 |

| Parametrii | Unitate măsură | de | | Probă | |
|------------------|-------------------|---------------------|----------------------------------|---------------------|----------------------------------|
| | | 1 – fără flux activ | 2 – cu SiO_2 flux activ | 1 – fără flux activ | 2 – cu SiO_2 flux activ |
| Putere laser | W | 2300 | 2000 | 2300 | 2000 |
| Frecvență | Hz | 150 | 150 | 150 | 150 |
| Durata pulsului | ms | 1 | 1 | 1 | 1 |
| Viteza de sudare | cm/min | 73 | 90 | 73 | 90 |





Active flux: SiO_2 + alcool polivinilic | 15 % & 30%



Avantaje

Creste gradul de absorbție fără supraîncălzirea materialului

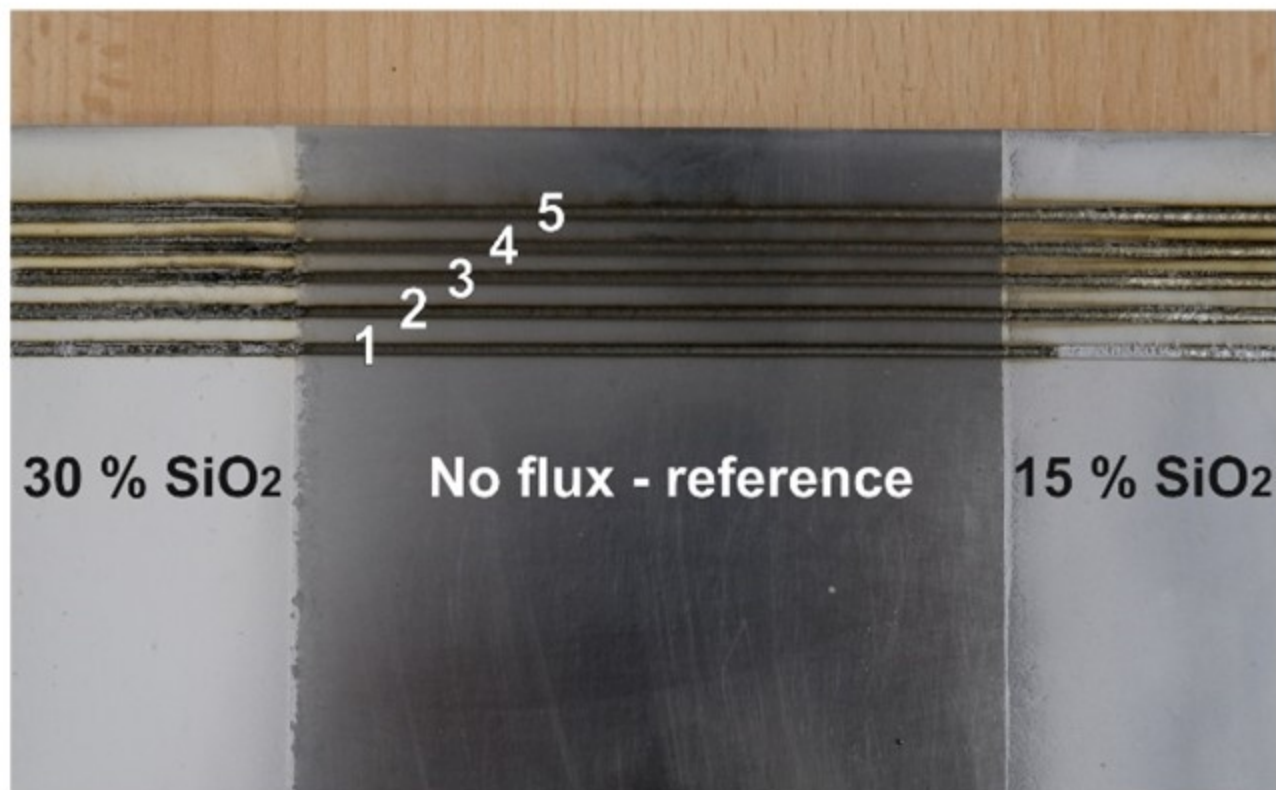
Creste adâncimea de pătrundere

Stabilitatea plasmei de sudare

80 cm/min, pulse length of 1 ms, and frequency of 120 Hz

(line 1 - 1500 W, line 2 - 2000 W, line 3 - 2500 W, line 4 - 3000 W, and line 5 - 3500 W)

Linii de fuziune – AISI 321 grosime 1.5 mm





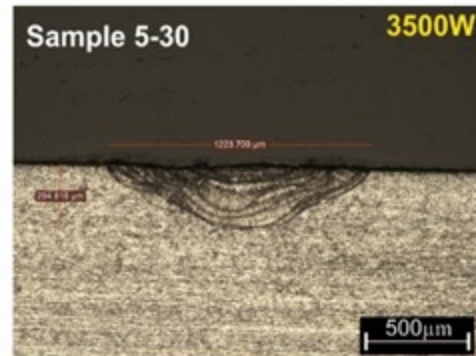
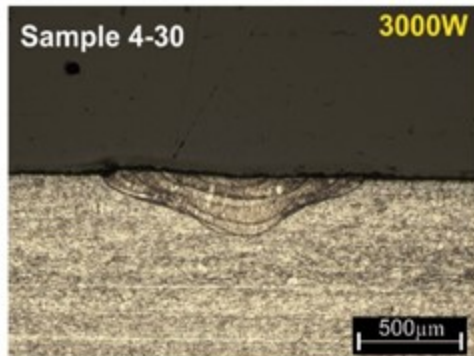
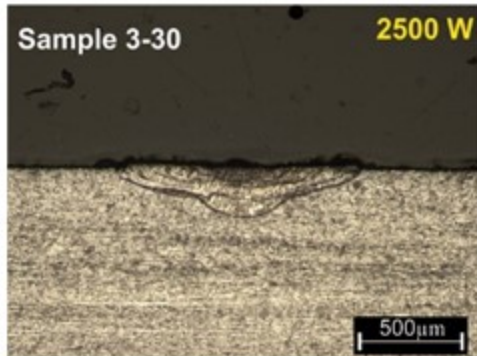
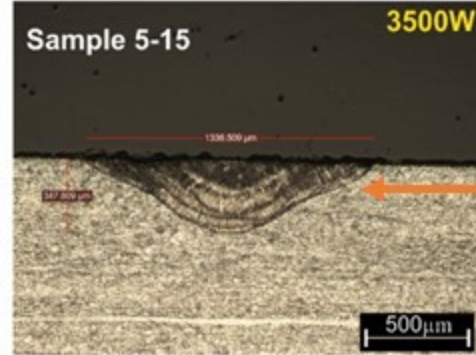
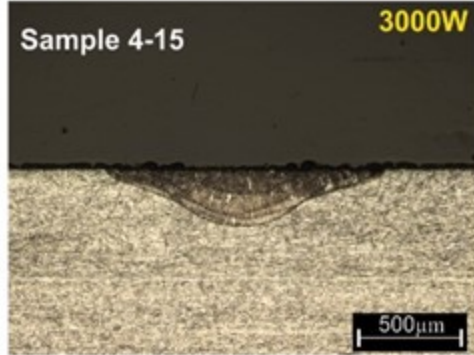
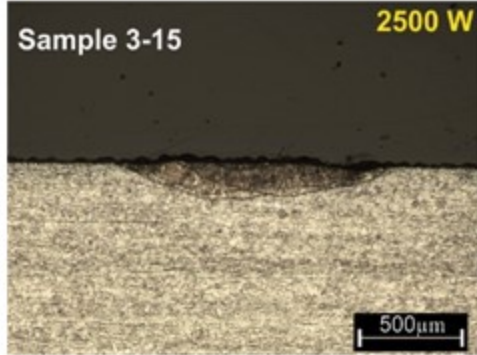
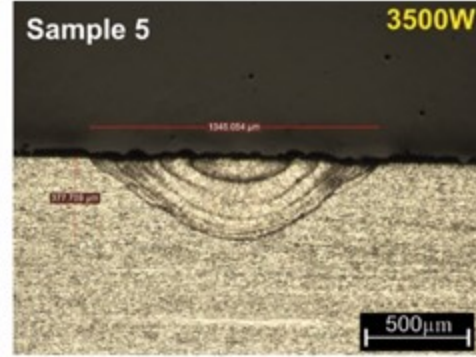
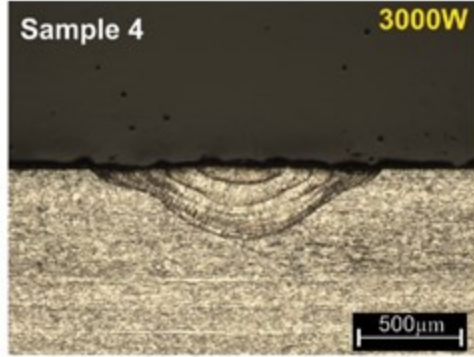
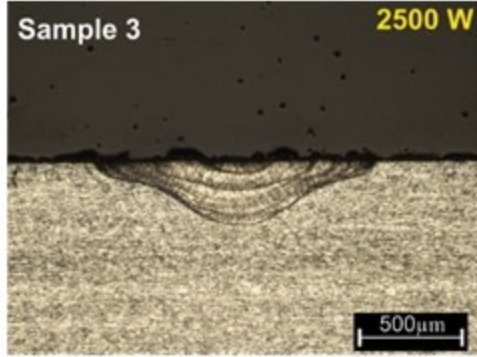
Cercetări experimentale



Sudarea cu laser a materialelor eterogene

AISI 1010 – AISI 321

FLUX ACTIV





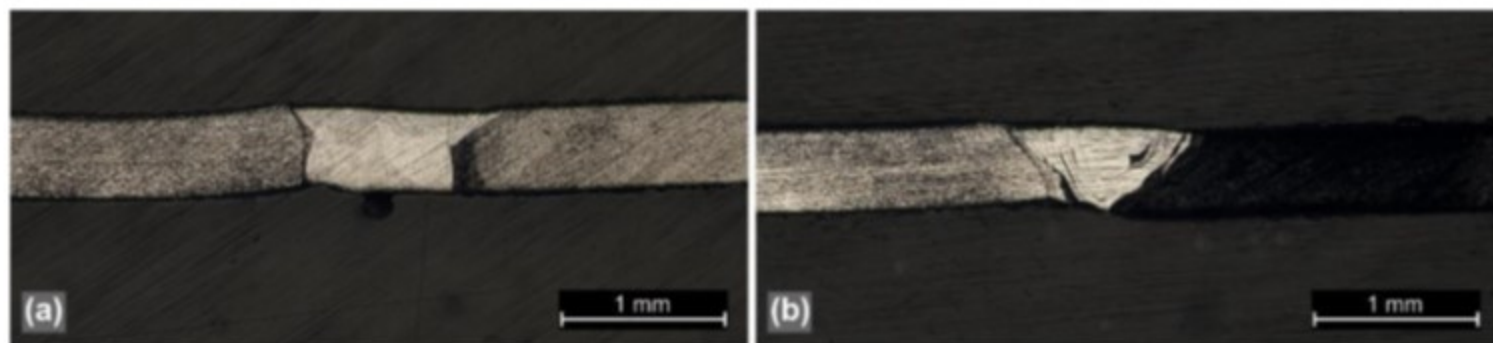
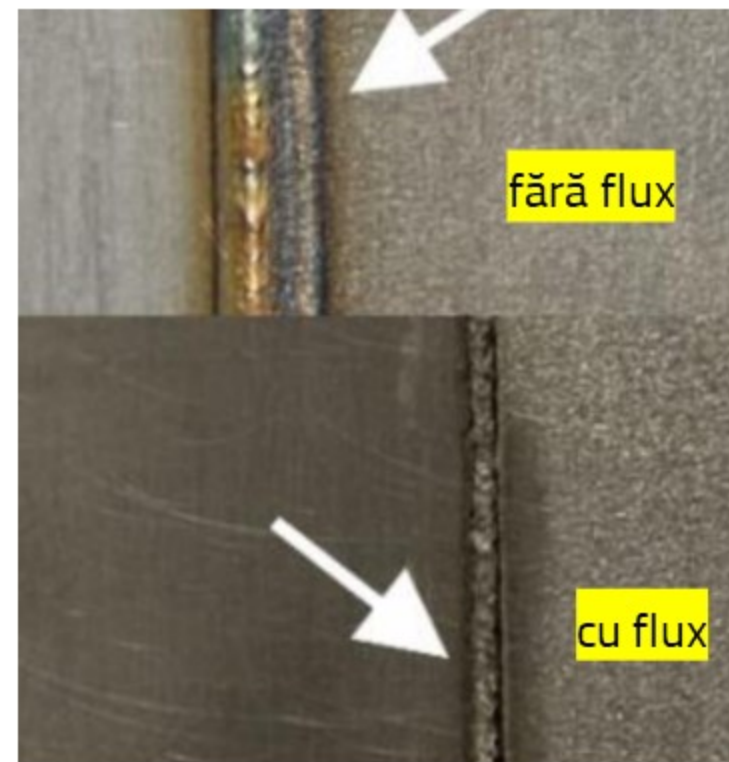
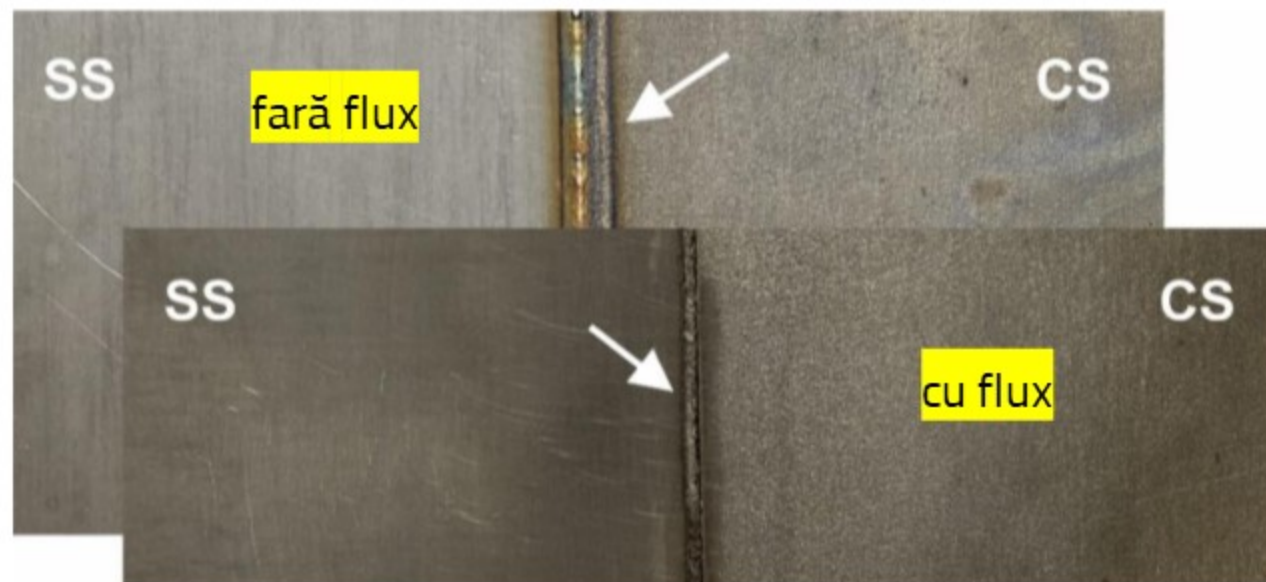
Cercetări experimentale



Sudarea cu laser a materialelor eterogene

AISI 1010 – AISI 321

FLUX ACTIV



Sudare cu laser.

A) fără flux,

B) cu flux SiO₂ 15%





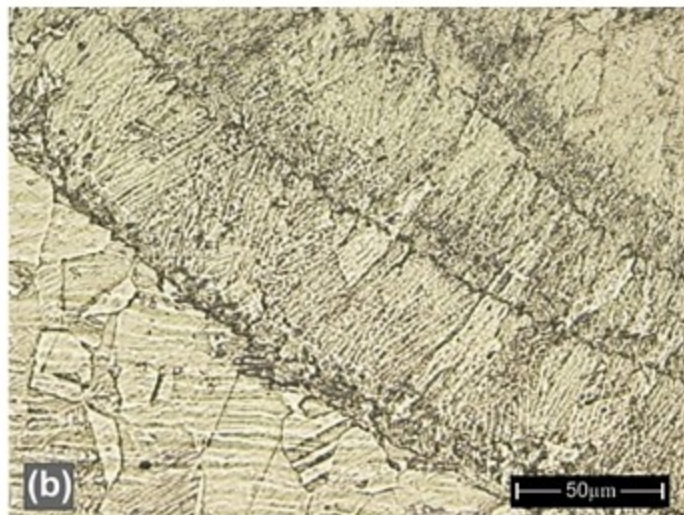
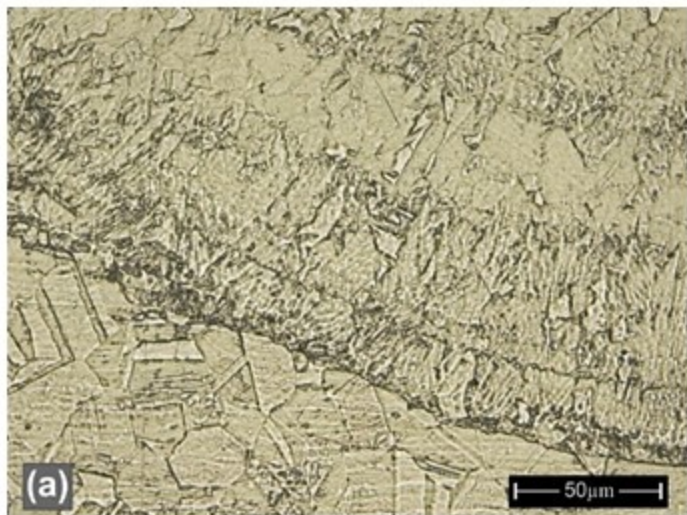
Cercetări experimentale



Sudarea cu laser a materialelor eterogene

AISI 1010 – AISI 321

FLUX ACTIV

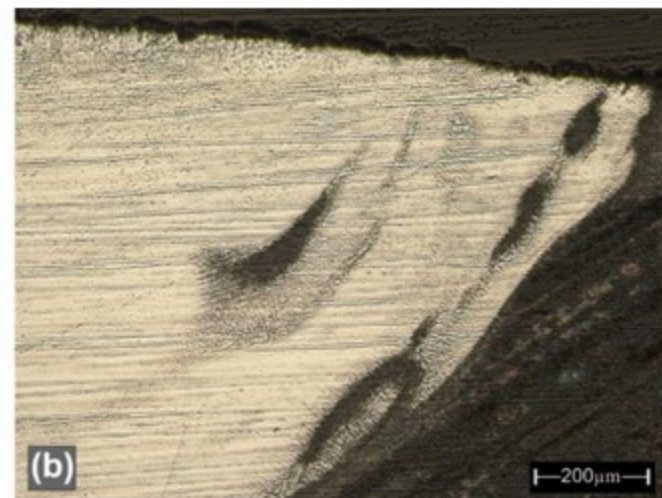
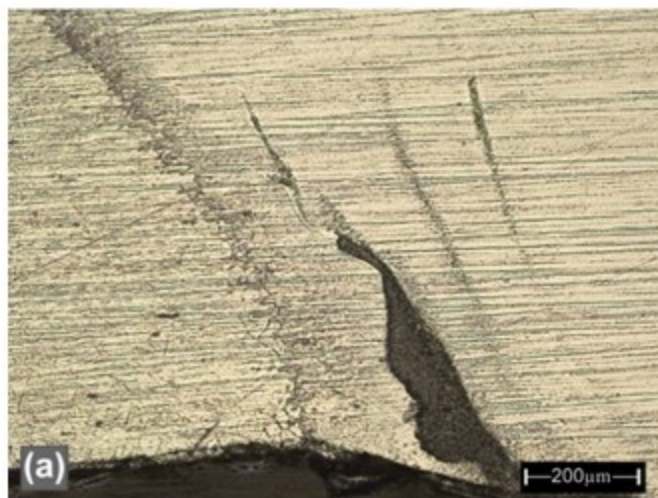


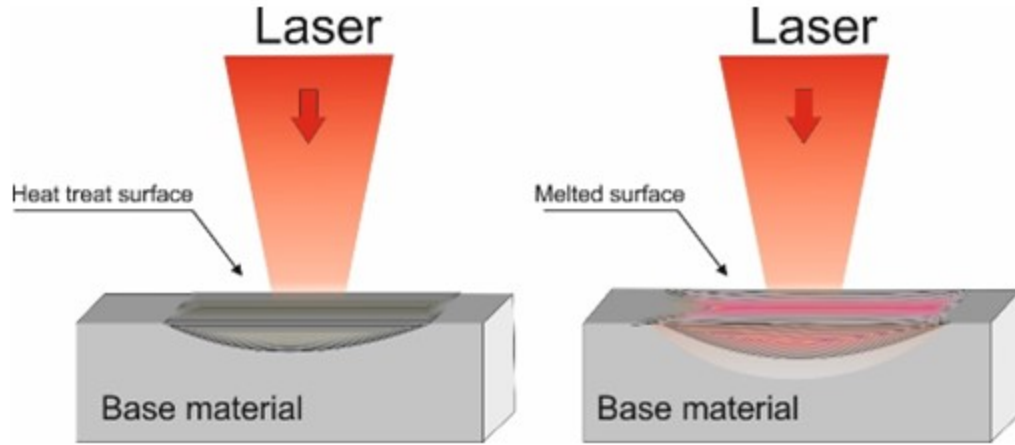
SiO₂ flux

Favorizează formarea feritei aciculare

Dezoxidarea băii de sudare

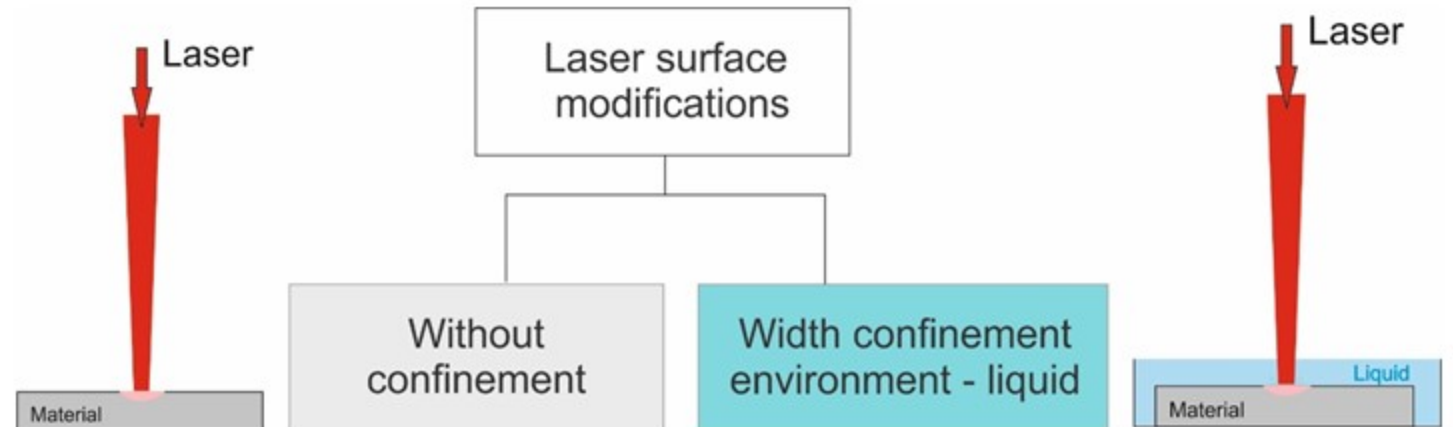
Reducerea cu pana la 18% a puterii laserului





Principiul tratamentului termic cu laser

Procesarea suprafeţei cu laser





Cercetări experimentale



Tratament termic superficial cu LASER

FeCrAl

FeCrAl

Materiale metalice avansate pentru noile generații de centrale nucleare, 4R PCCA 243/2014

Obținerea, testarea și tratarea superficială a unor noi aliaje destinate centralelor nucleare din generația 4R



CO Universitatea POLITEHNICA din București

Director de proiect Prof. Dr. Ing. Victor GEANTĂ, tel. 021 4029521, Fax: 021 4029521, email:

victorgeanta@yahoo.com



excelența în cercetare - dezvoltare

P1 SC OPTOELECTRONICA-2001 SA

Responsabil de proiect Dr. Ing. Elena-Manuela STANCIU



P2 Institutul National de Cercetare Dezvoltare pentru Fizica si Inginerie Nucleara "Horia Hulubei"

Responsabil proiect Dr. Viorel FUGARU



P3 SC UPS PILOT ARM SRL

Responsabil de proiect Prof. Dr. Ing. Tudor CHEHECHEȘ



P4 SC METAV – Cercetare Dezvoltare SRL

Responsabil de proiect CP II Ing. Dana Daisa



| Probă | Compoziție chimică, wt.% | | | |
|-------|--------------------------|-----|------|----------------|
| | Cr | Al | Fe | Alte elemente* |
| S1 | 8.3 | 6.2 | 80.9 | 4.5 |
| S2 | 10.7 | 5.1 | 83.1 | 1.1 |
| S3 | 13.9 | 4.1 | 81.1 | 0.9 |
| S4 | 16.2 | 4.1 | 78.8 | 0.9 |



Cercetări experimentale



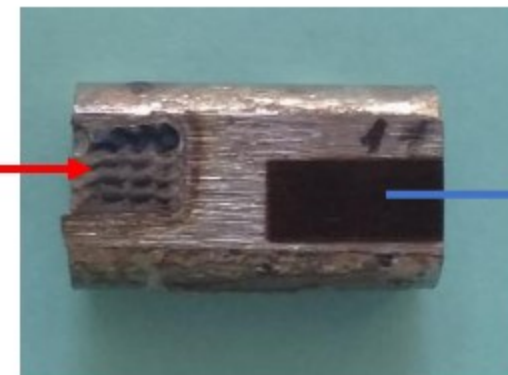
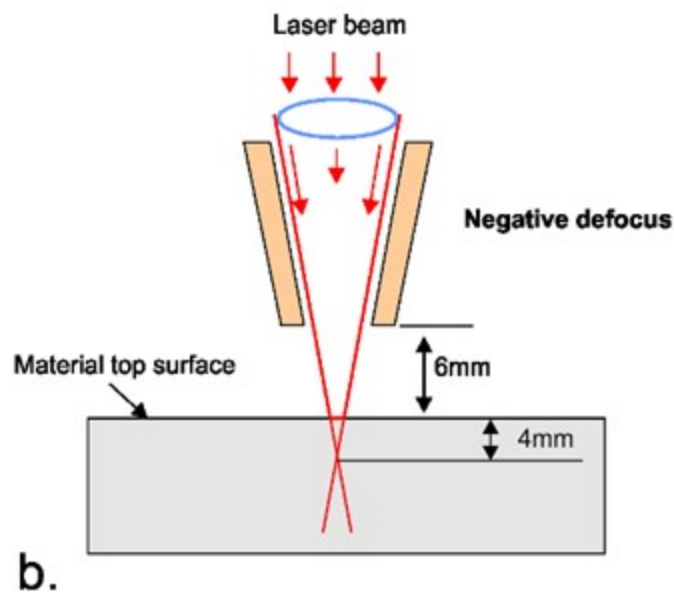
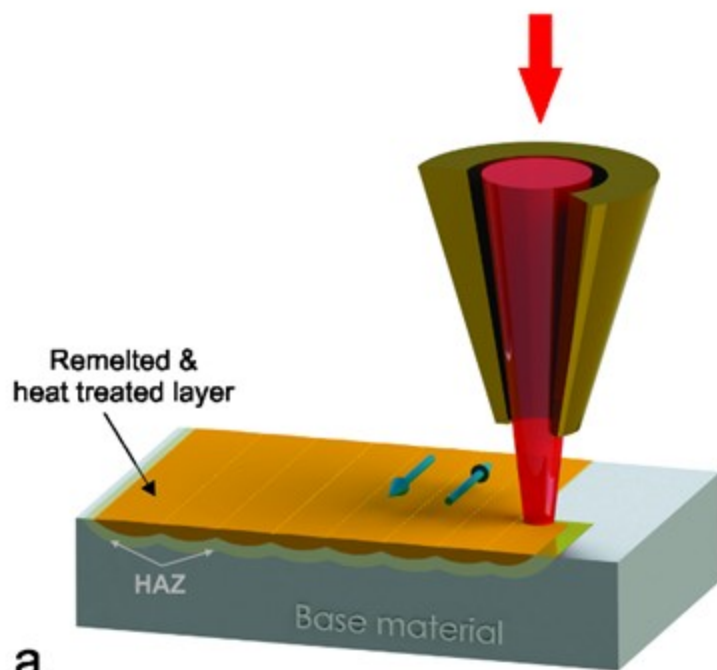
Tratament termic superficial cu LASER

FeCrAl

Procesarea suprafeţei cu laser

LASER continuu Coherent 1000 F
Lungime de undă 975 nm
Distanţa focală 150 mm
Gaz de protecţie Argon

optoelectronica
excelenţa în cercetare · dezvoltare

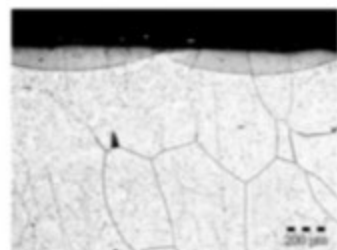




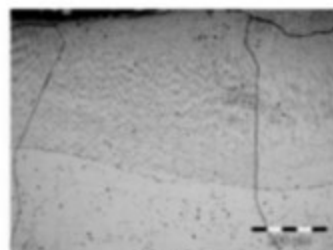
| Parametrii / Regim | Putere [W] | Viteza de procesare [cm/min] | Diametrul spotului [mm] | Flux gaz (Ar) [l/min] | Distanţa focală [mm] |
|-----------------------|---------------|------------------------------------|-------------------------------|--------------------------|-------------------------|
| 1 | 320 | 80 | 1.1 | 7 | 6 |
| 2 | 500 | 80 | 1.1 | 7 | 6 |

Adâncimea zonei procesate |
retopite cu laser este cuprinsă între
min 68 μm (proba 3) la 320W
şi
max. 519 μm (proba 1) la 500W.

S1

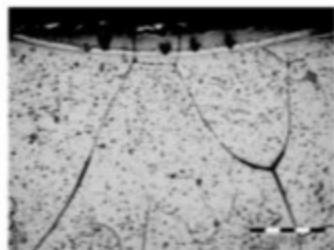


Regime 1,
penetration depth – 137 - 163 μm

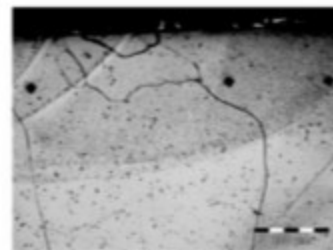


Regime 2,
penetration depth – 467-519 μm

S3

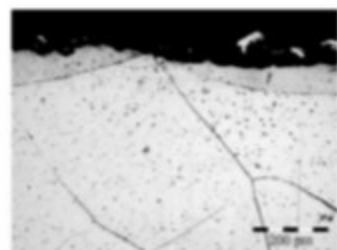


Regime 1,
penetration depth – 68 – 72 μm

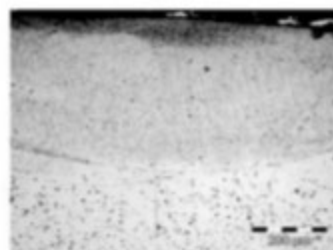


Regime 2,
penetration depth – 351 - 393 μm

S2

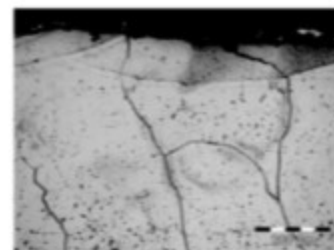


Regime 1,
penetration depth – 119-142 μm

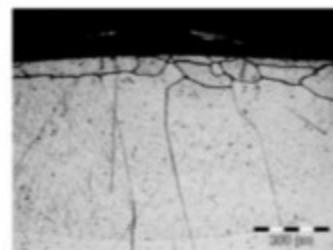


Regime 2,
penetration depth – 440 - 466 μm

S4



Regime 1,
penetration depth – 112-129 μm



Regime 1,
penetration depth – 404 - 442 μm



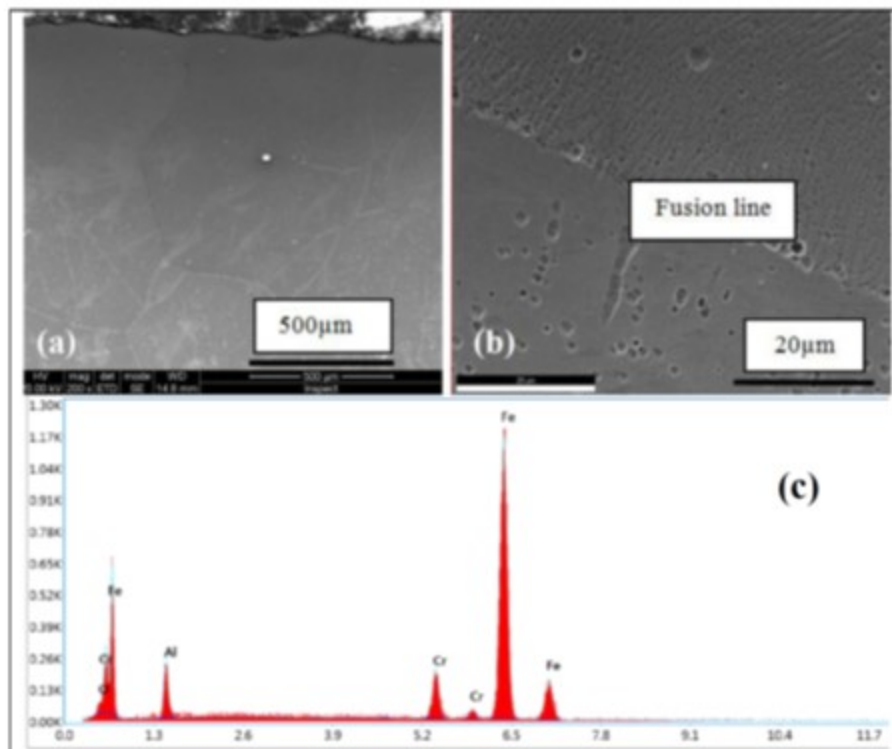


Cercetări experimentale



Tratament termic superficial cu LASER

FeCrAl



| ELEMENT | GREUTATE % | ATOMICE % | EROARE % |
|---------|------------|-----------|----------|
| O K | 0.46 | 1.49 | 37.98 |
| AL K | 6.54 | 12.44 | 10.66 |
| CR K | 9.7 | 9.57 | 5.44 |
| FE K | 83.29 | 76.51 | 2.45 |

| ELEMENT | GREUTATE % | ATOMIC % | EROARE % |
|---------|------------|----------|----------|
| O K | 0.27 | 0.86 | 75.98 |
| AL K | 6.72 | 12.81 | 10.51 |
| CR K | 9.58 | 9.48 | 5.42 |
| FE K | 83.43 | 76.84 | 2.43 |





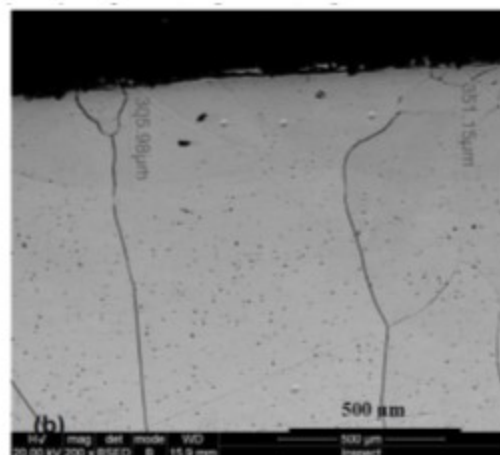
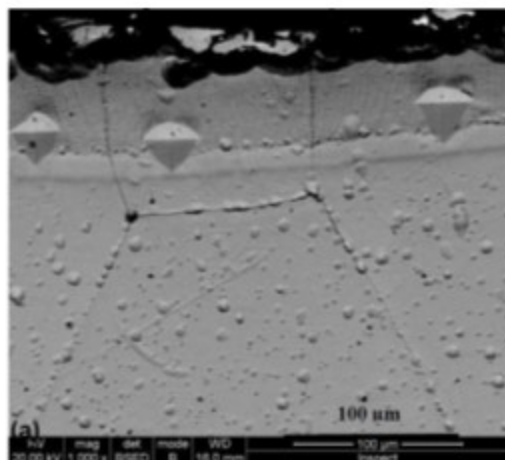
Cercetări experimentale



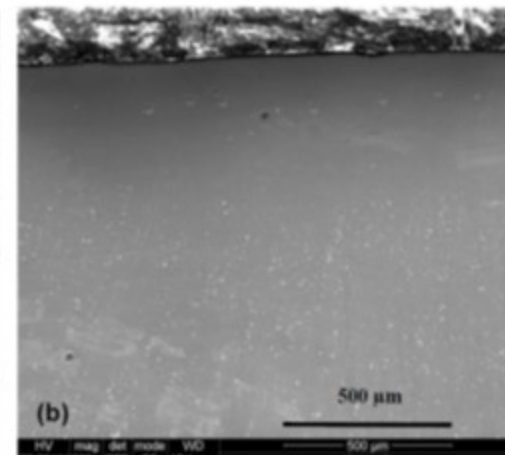
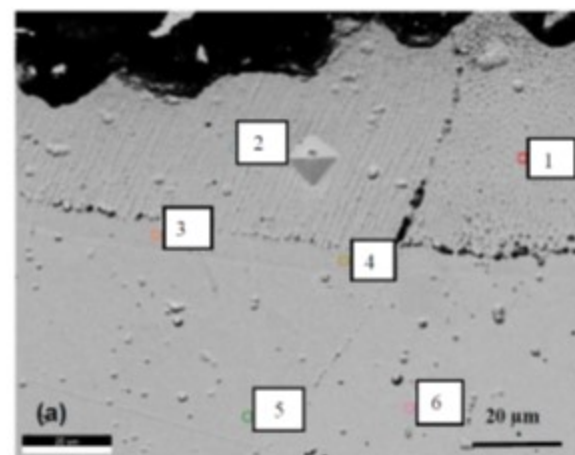
Tratament termic superficial cu LASER

FeCrAl

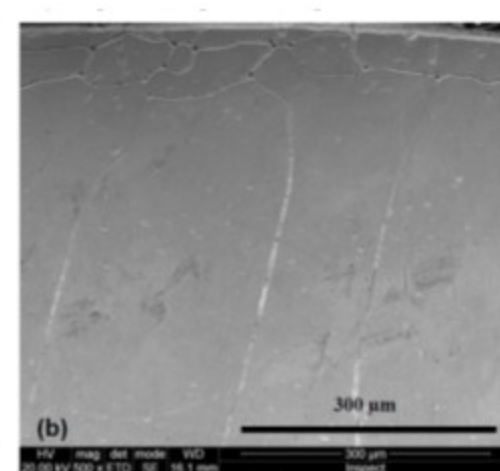
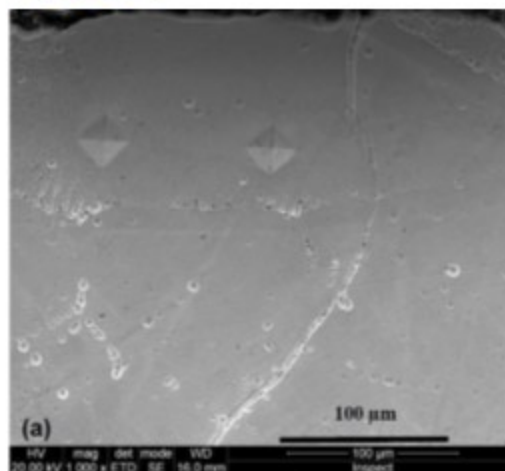
Proba 2



Proba 3



Proba 4



Microduratea zonei procesate cu laser

| Probă | Regimul 1 | Regimul 2 | Material de bază |
|-------|-----------|-----------|------------------|
| S1 | 265 | 245 | 228 |
| S2 | 255 | 249 | 213 |
| S3 | 238 | 221 | 223 |
| S4 | 242 | 240 | 231 |



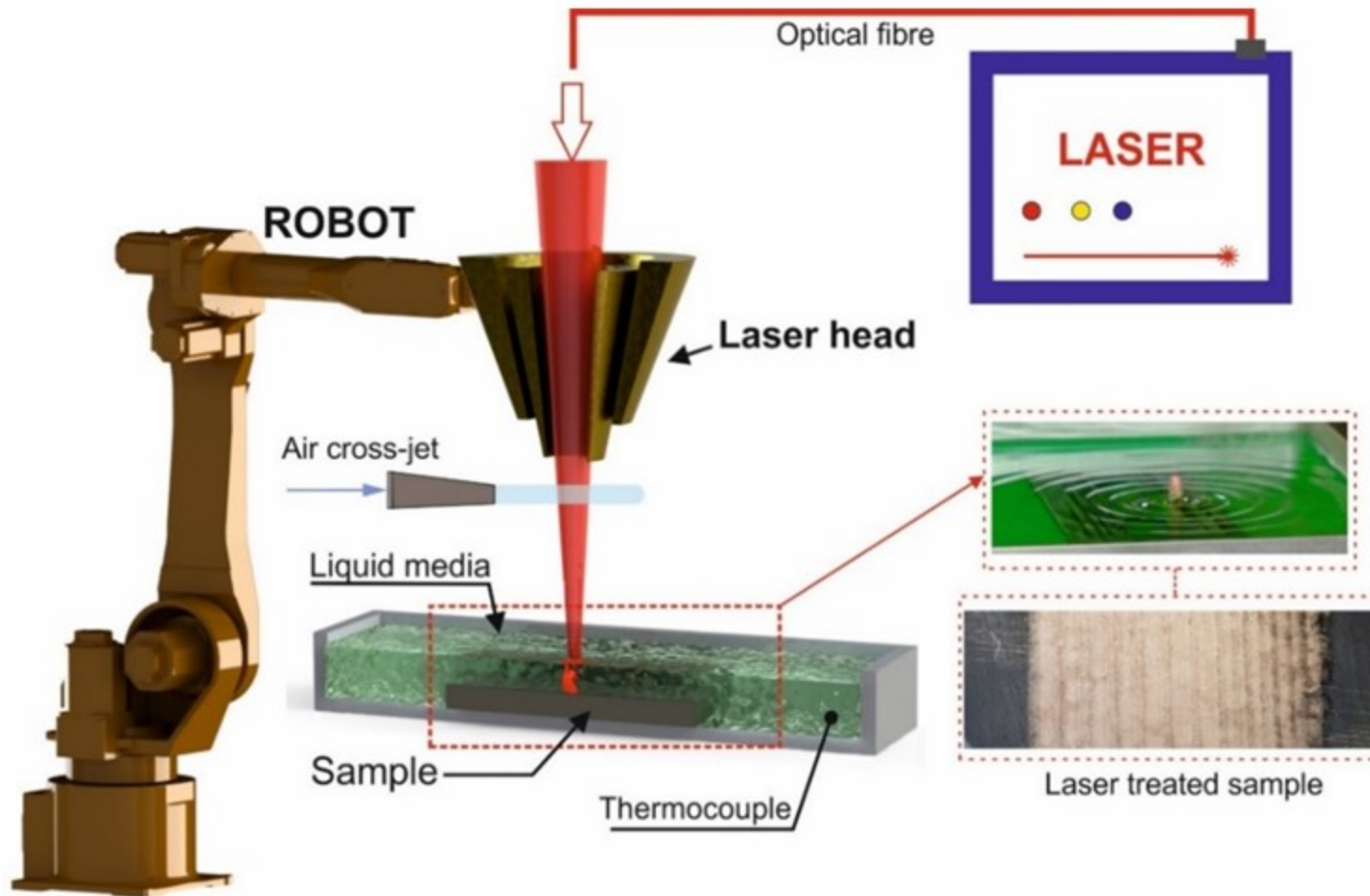


Cercetări experimentale



Tratament termic superficial cu LASER

Mediu lichid





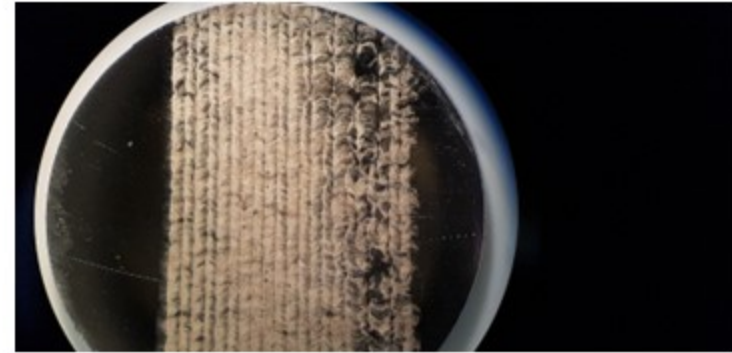
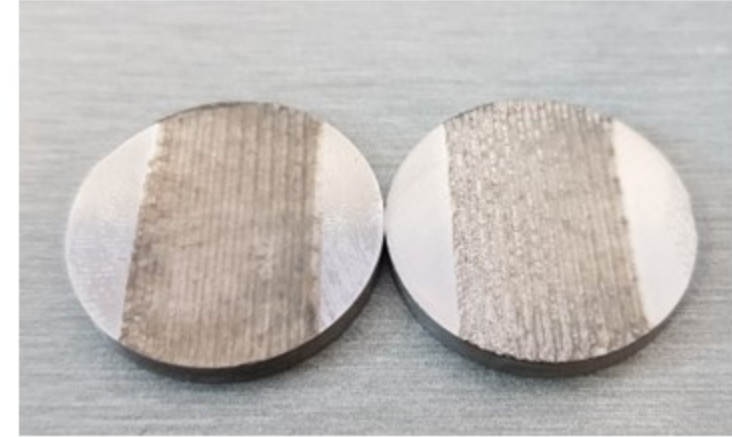
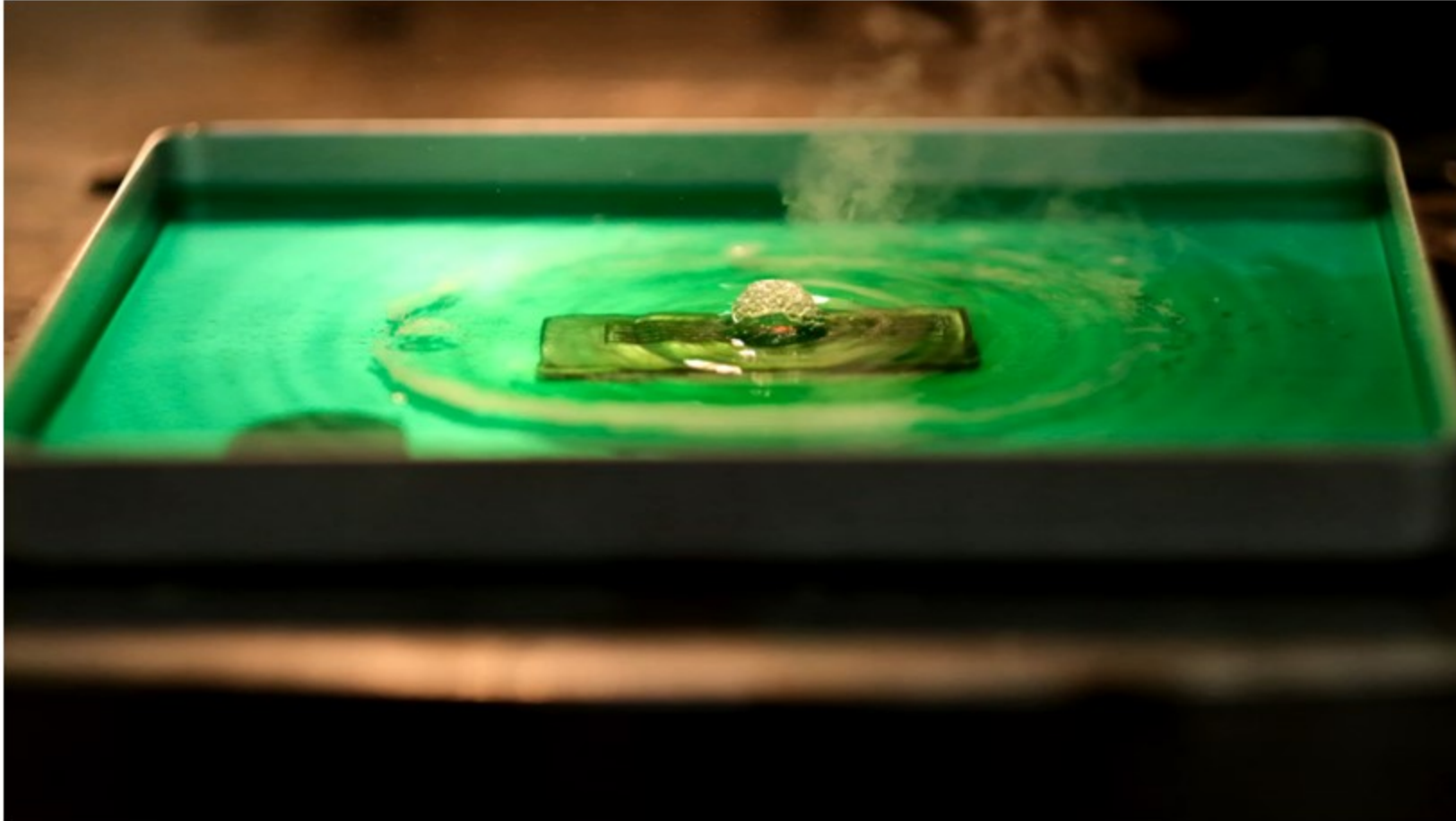
Cercetări experimentale



Tratament termic superficial cu LASER

Mediu lichid

Acetat de nichel





Cercetări experimentale



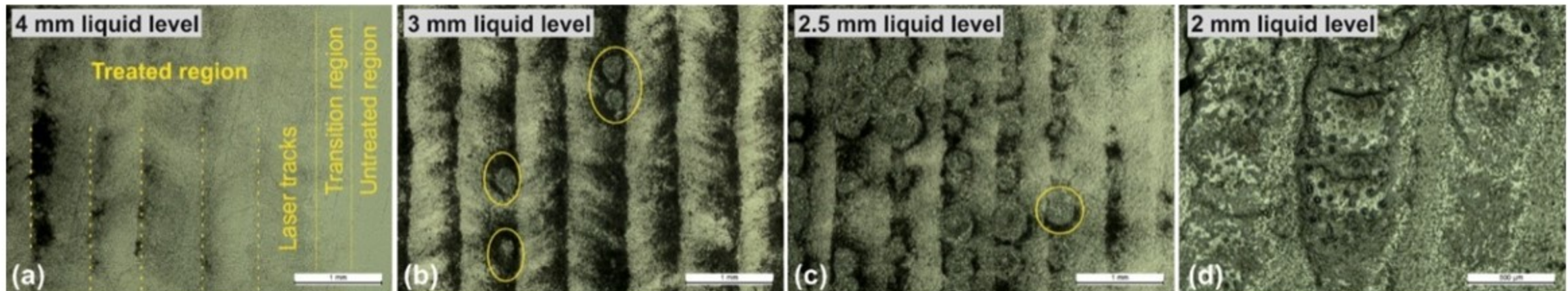
Tratament termic superficial cu LASER

Mediu lichid

Acetat de nichel

| Material | Wt.% | | | | | | | | |
|----------|------|------|------|------|------|------|------|------|-------|
| | C % | Mn% | Cr% | Ni% | Si% | P% | Mo | S% | Fe% |
| C45 E | 0.46 | 0.80 | 0.38 | 0.12 | 0.09 | 0.01 | 0.06 | 0.03 | 98.05 |

| Putere laser [W] | Diametrul spotului [mm] | Energia laserului [J] | Durata pulsului [ms] | Frecvenţa [Hz] | Viteza [mm/s] | Suprapunere [%] |
|------------------|-------------------------|-----------------------|----------------------|----------------|---------------|-----------------|
| ~ 184 | 1 | 0.38 | 0.7 | 480 | 8 | 20 |



Cercetări experimentale



Tratament termic superficial cu LASER

Mediu lichid

Acetat de nichel

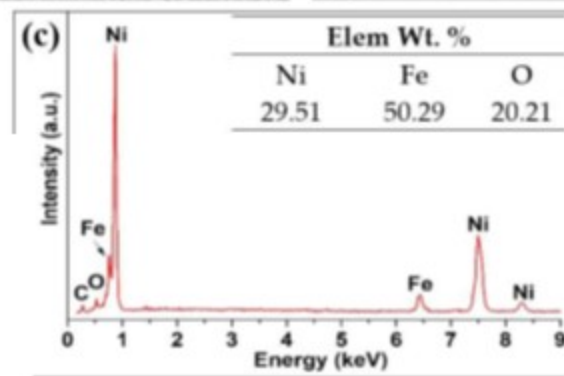
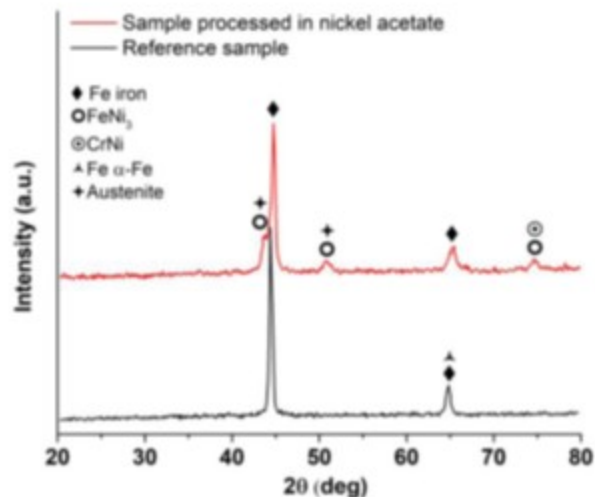
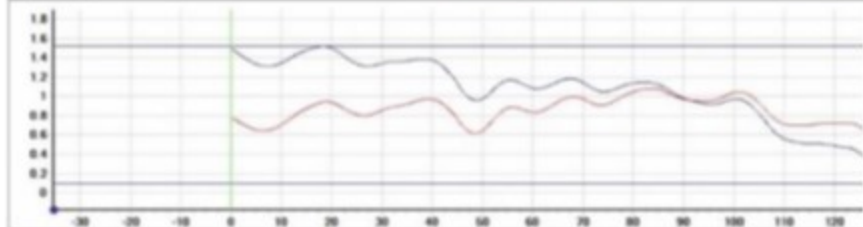
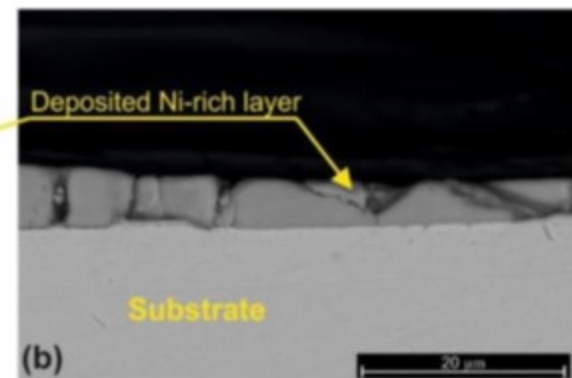
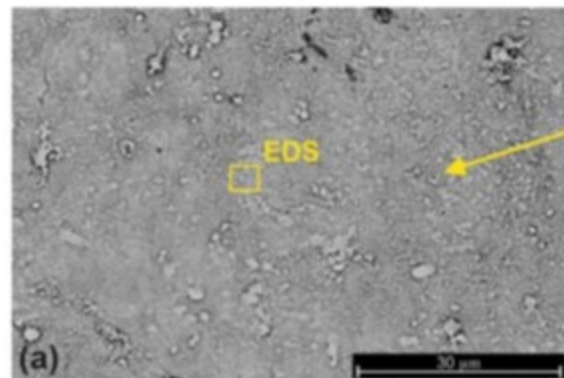
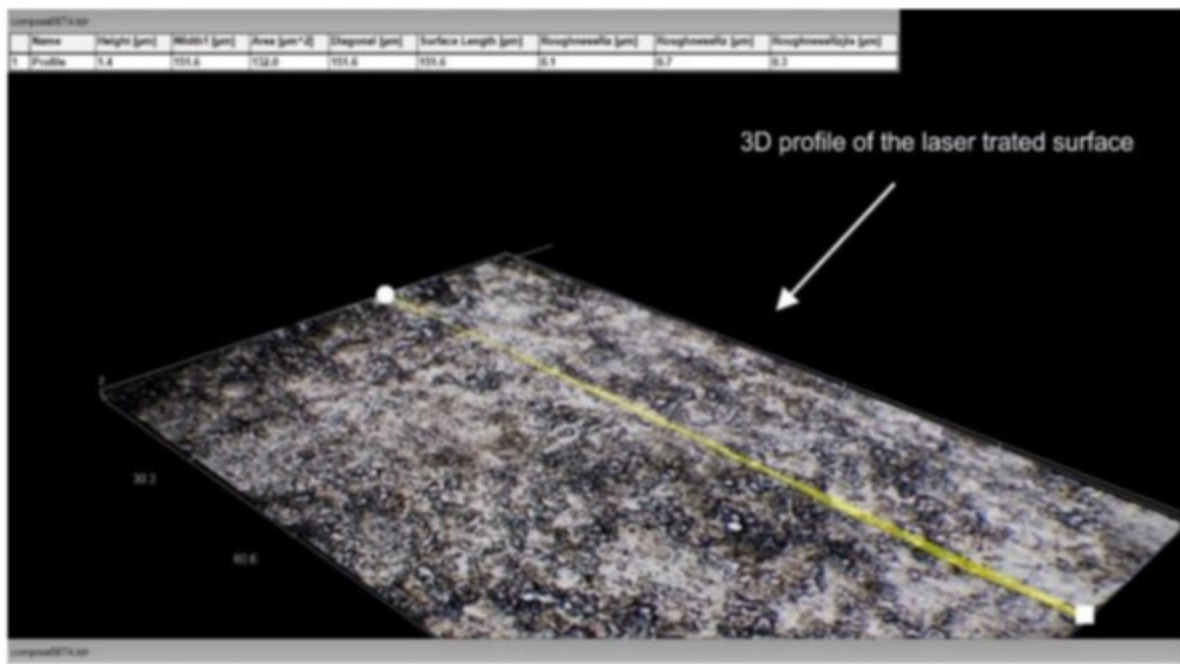


Figure 5.3. 3D scanning and surface profile measure (Hirox KH-8; [STA23].



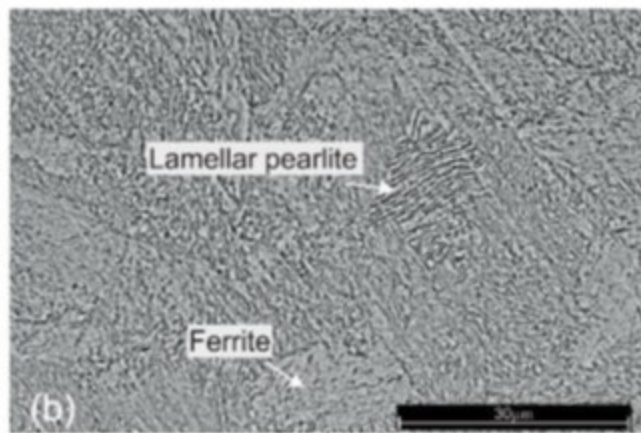
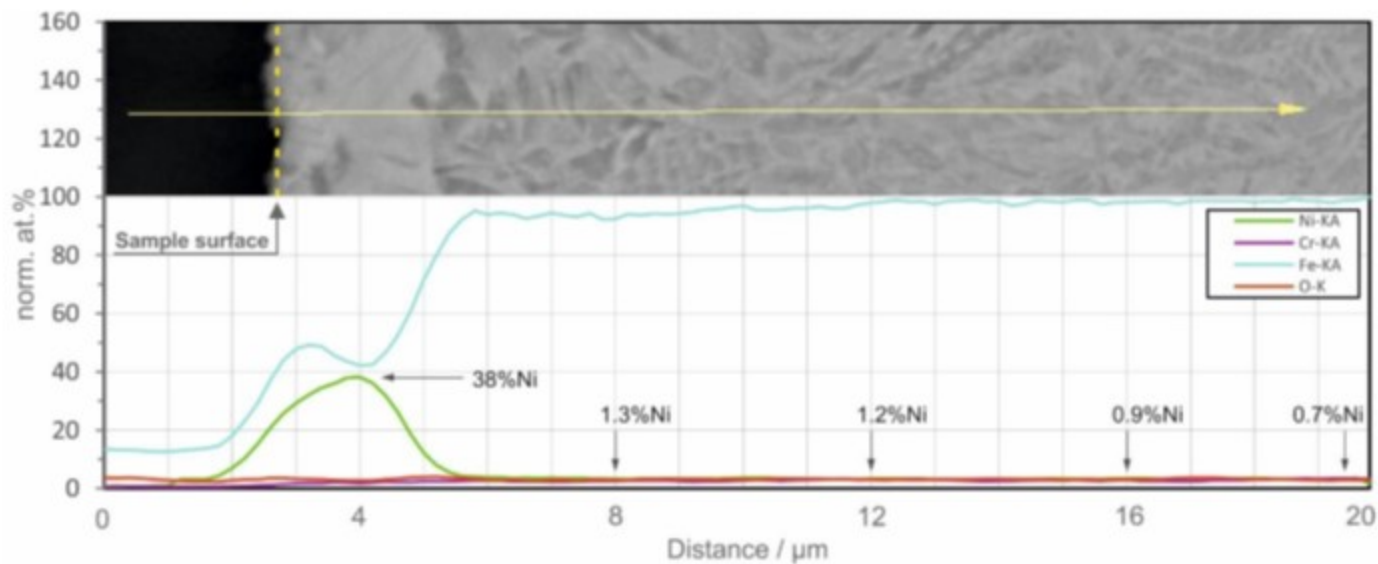
Cercetări experimentale



Tratament termic superficial cu LASER

Mediu lichid

Acetat de nichel





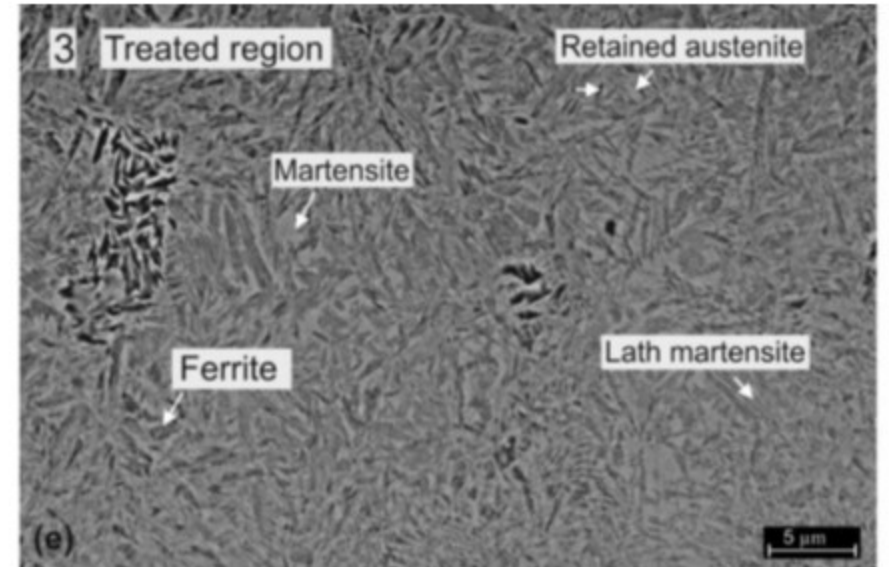
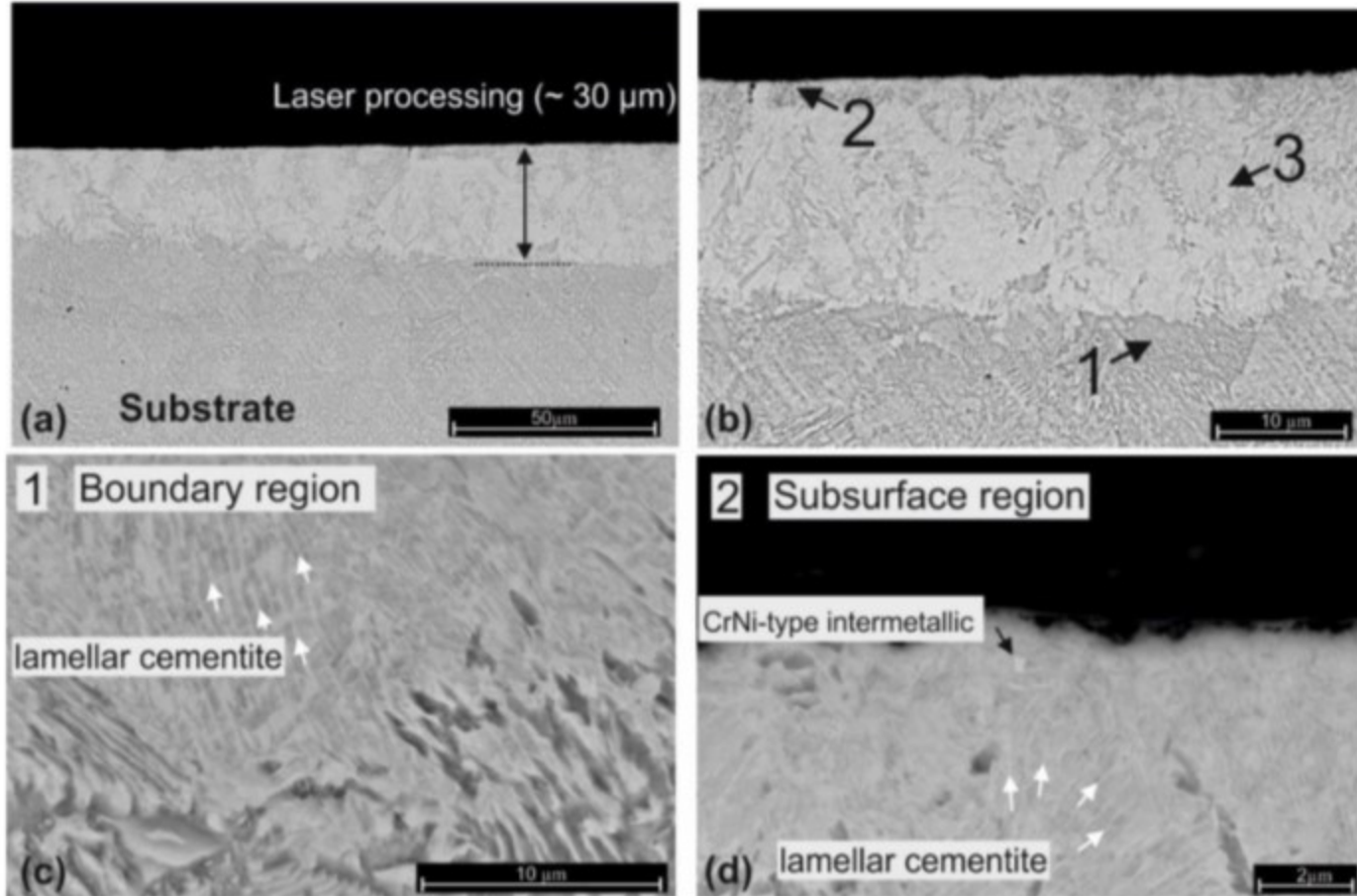
Cercetări experimentale



Tratament termic superficial cu LASER

Mediu lichid

Acetat de nichel





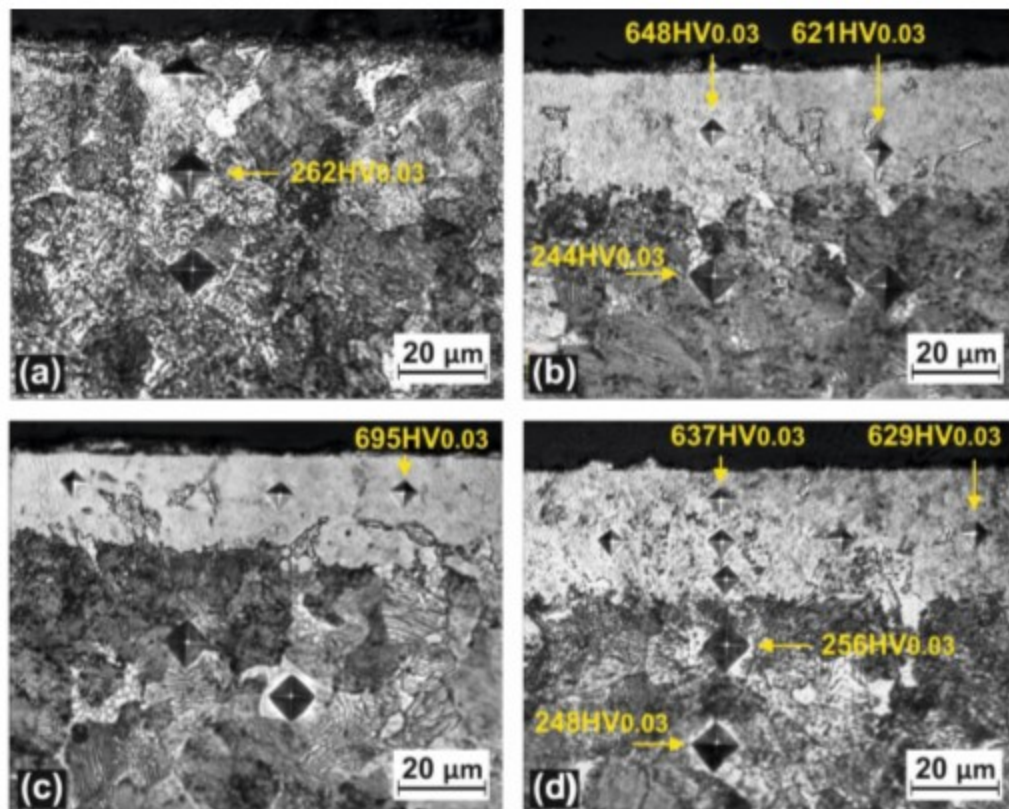
Cercetări experimentale



Tratament termic superficial cu LASER

Mediu lichid

Acetat de nichel



| Region | Depth from the surface [μm] | Microhardness $\text{HV}_{0.03}$ |
|------------------|---|-------------------------------------|
| Treated region | 10 | 663 ± 9.2 |
| | 20 | 627 ± 3.6 |
| | 30 | 621 ± 4.6 |
| Boundary region | 40 - 50 | 459 ± 11.0 |
| Untreated region | 60 | 259 ± 3.6 |
| | 70 | 248 ± 1.4 |
| | 80 | 246 ± 1.1 |





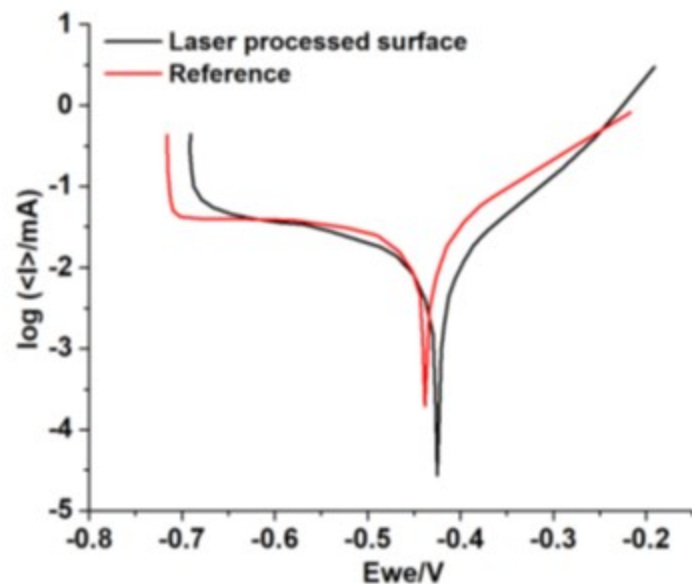
Cercetări experimentale



Tratament termic superficial cu LASER

Mediu lichid

Acetat de nichel



Corrosion test parameters and results

Table 5.4

| Operational parameters | No processing | Laser processing |
|------------------------|---------------------------|---------------------------|
| E_{corr} | -437.4 mV | -435.5 mV |
| I_{corr} | 25.0 μA | 11.3 μA |
| b_c | 669.9 mV | 285.1 mV |
| b_a | 141.9 mV | 117.1 mV |
| Corrosion rate | 0.094 mm/year ± 0.006 | 0.042 mm/year ± 0.003 |





Concluzii

1. A fost realizat un stadiu actual al utilizării tehnologiei laser pentru aplicații cu potențial industrial.
2. S-au determinat experimental parametrii optimi pentru depunerea cu laser și pulberi metalice aliate cu CW. Alierea suplimentară cu Al s-a dovedit a fi benefică pentru păstrarea integrității particulelor dure la depunerile cu laser.
3. Am proiectat și utilizat un flux activ pe baza de SiO_2 și alcool polivinilic care a îmbunătățit gradul de absorbție a fasciculului laser și a facilitat formarea feritei aciculare la îmbinările eterogene de tipul oțel carbon – oțel inoxidabil austenitic.
4. Au fost optimizați parametrii pentru sudarea cu laseri pulsați a oțelurilor inoxidabile AISI 316L. Am determinat experimental valorile optime pentru puterea laserului, durata pulsului și frecvență, și influența acestor parametrii asupra geometriei cordonului sudat.
5. Am realizat un studiu experimental privind sudarea cu laser a materialelor eterogene de tipul AISI 1010 – AISI 321.
6. Am realizat o tehnologie nouă de procesare cu laser în mediu lichid de acetat de nichel, tehnică care a permis tratarea termomecanică a substratului din C45 și microalierea acestuia cu nichel.
7. S-a determinat experimental influența geometriei modului de depunere la depunerile coaxiale cu laser utilizând 3 tipuri de conuri cu deschiderea de 20, 25 și 32°.
8. S-au îmbunătățit proprietățile mecanice și rezistența la coroziune a aliajelor de tipul FeCrAl prin procesare superficială cu laser.



Studii de licenţă 2003-2008

Studii de masterat 2008-2010

Studii de masterat 2009-2011

Doctor în inginerie industrială 2008-2011



Felipe VI, Rey de España

Rectore de la Universidad Politécnica de Madrid



Diplomă de doctor 480/
9.01.2012



BII – Realizări profesionale

Studii postdoctorale 2013-2015

*Sudarea cu laser a cuplului de materiale
AISI 321 –AISI 1010*

Tutore postdoctorat: Prof. Dr. Ing.
Mircea-Horia ȚIEREAN



- Sudarea cu laser;
- Texturarea și procesarea superficială cu fascicul laser a diferitelor materiale convenționale sau materiale avansate de tipul FeCrAl;
- Depunerea cu laser și pulberi.



Abilitare





BII – Realizări profesionale

Asistent cercetare

2011– 2013 | Optoelectronica 2001 SA Măgurele Ilfov

Cercetător ştiinţific grad 3

2013 – 2017 | Optoelectronica 2001 SA Măgurele Ilfov

- Propunerea şi derularea de proiecte de cercetare, realizarea de cercetări experimentale, diseminarea rezultatelor cercetărilor în jurnale şi conferinţe de specialitate interne şi internaţionale

Cadru didactic

2016-2024 Facultatea de Ştiinţa şi ingineria materialelor

- 2016- 2018 Şef de lucrări
- 2018 – 2024 Conferenţiar





BII – Realizări profesionale

Stanciu, Elena Manuela

Universitatea Transilvania din Braşov, Braşov 35146764400 <https://orcid.org/0000-0002-8025-4822>

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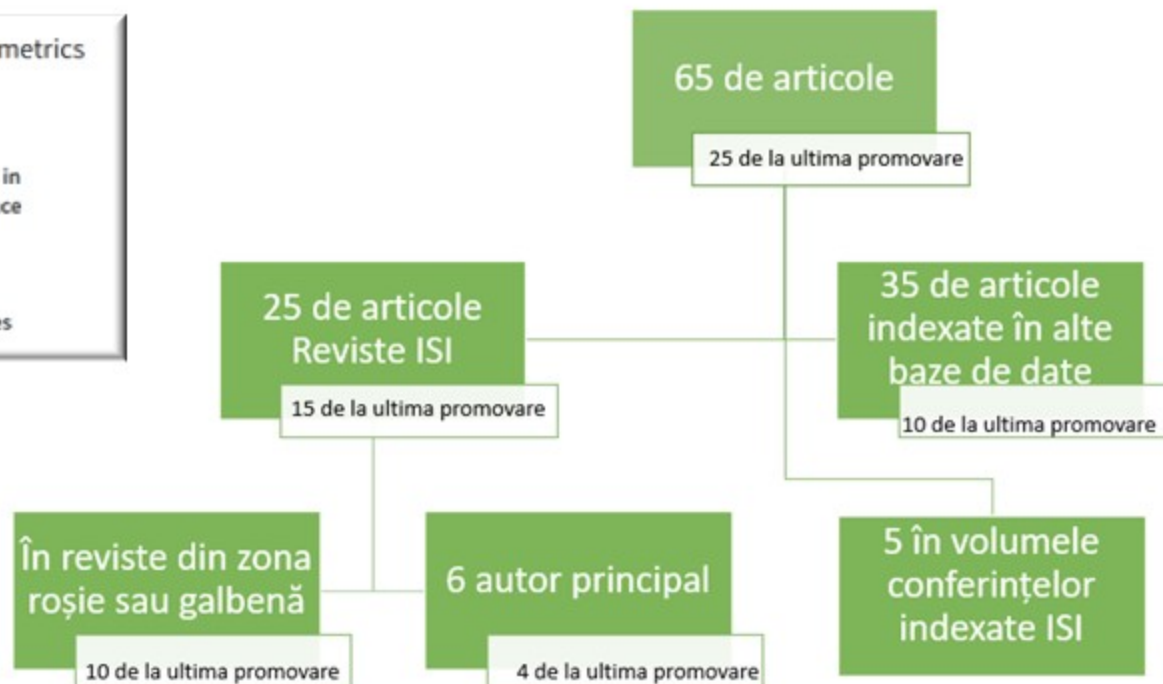
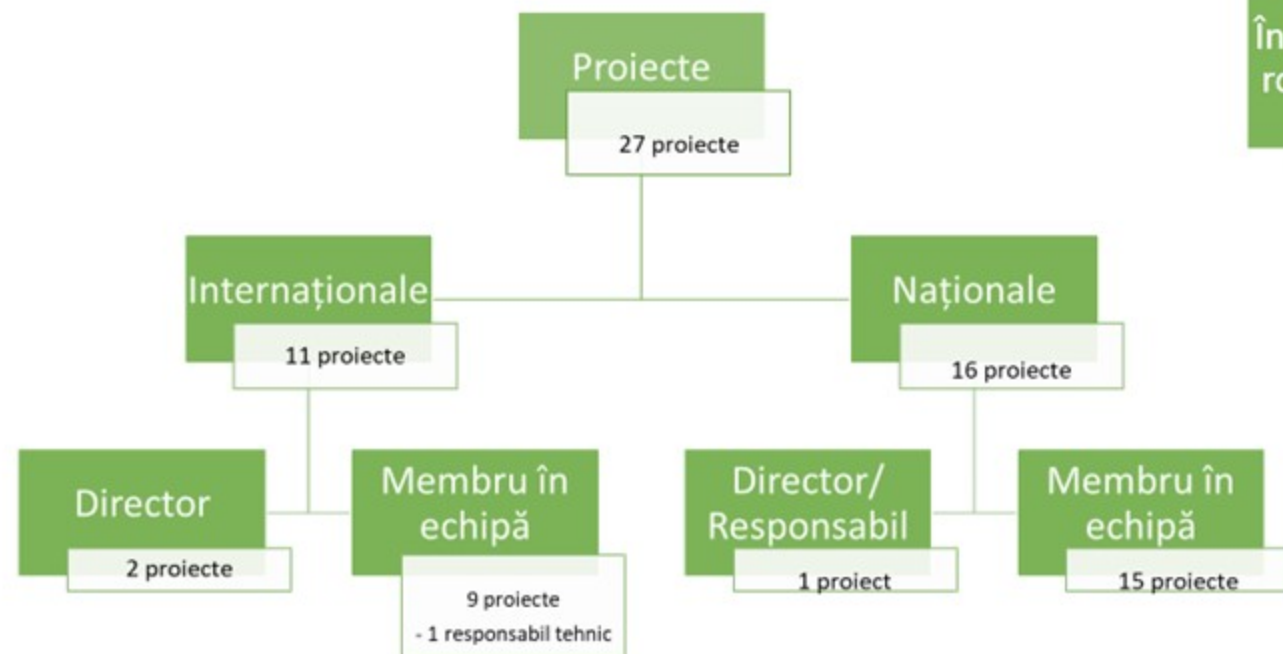
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BII – Realizări profesionale

1. Advanced Metallic Materials for New Generation Nuclear Power Plants, 4R, NUCLEARMAT (PCCA 243/2014, **în calitate de responsabil de proiect**)
2. Solar Synthesis of Functional Carbonaceous under Constant Electric Charge - SFERA III" (2019, France).
3. Corrosion and Wear Behavior of NiCrBSi Coatings Fabricated by Laser Cladding, European Solar Research Infrastructure for Concentrated Solar Power - SFERA II" (2016, Italy).

At the same time, my role as a **project team member** has been pronounced across various national and international research grants, such as:

1. "Studies Concerning the Real-Time Monitoring of the Laser Welding/Cutting Process" and "New Methods for Cutting Metallic Waste". Third party project with EU private sector (2015-2018, Netherlands). Project coordinated by Prof. Mircea Horia Țierean from Transilvania University of Brasov.
2. **Persoană cheie a proiectului** "Reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste"- RECLAIM, FP7 grant type, grant agreement no: 309620 <https://cordis.europa.eu/project/id/309620/reporting>. Project coordinated by Brânduș Comănescu from Optoelectronica – 2001 SA, Măgurele.
3. "Perovskites for Photovoltaic Efficient Conversion Technology", 8 SEE grant type, EEA-JRP-RO-NO-2013-1, Project coordinated by Prof. Mihaiela Iliescu from Optoelectronica – 2001 SA, Măgurele.
4. "Compact biophotonic platform for drug allergy diagnosis" – COBIOPHAD, H2020 grant type, Grant agreement no: 688448, Project coordinated by Dr. Necșoiu Teodor from Optoelectronica – 2001 SA, Măgurele.
5. "Improvement of Electric Contact Corrosion Resistance", SFERA II type project (2014, Italy). Project coordinated by Dr. Ionut Roată from Transilvania University of Brasov
6. "Mechanical proprieties improvement of Cu10Al laser clad on aluminium", SFERA II type project (2014, Spain). Project coordinated by Dr. Ionut Roată from Transilvania University of Brasov.
7. "Residual stress relieve of Ni based coatings fabricated by laser cladding", SFERA II type project (2015, France). Project coordinated by Prof. Pascu Alexandru from Transilvania University of Brasov.
8. "[Synthesis of carbon nanotubes using solar radiation and Al₂O₃-Mn/Cu₂O catalyst](#)", SFERA II type project (2016, France). Project coordinated by Prof. Pascu Alexandru from Transilvania University of Brasov
9. "Al₂O₃/TiO₂ cladding in pre-placed powder geometry using concentrated solar radiation", SFERA II type project (2017, France). Project coordinated by Prof. Pascu Alexandru from Transilvania University of Brasov.
10. "Corrosion improvement of FeCrAl alloys designed for Molten Salt Reactors", SFERA II type project (2017, Italy). Project coordinated by Prof. Pascu Alexandru from Transilvania University of Brasov.
11. "Research on the Development of Diode-Pumped Laser Equipment Family for Medical Applications, Especially Urology" - ELASMEDURO, POS-CCE type project, No.159/2011. Project coordinated by Brânduș Comănescu from Optoelectronica – 2001 SA, Magurele.
12. "Advanced and Extended Functionality Complex System for Document Examination and Scientific Research in the Field of Forensic", grant type PN-II-IN-DPST-2012-1-0026. Project coordinated by Dr. Necșoiu Teodor from Optoelectronica – 2001 SA, Măgurele.
13. "Application of Laser Techniques for Manufacturing Real-Time Microfluidic-Based Biosensors SOLE", grant type PN-II-PT-PCCA-2013-4-1992, grant number 34/01.07.2014. Project coordinated by Dr. Necșoiu Teodor from Optoelectronica – 2001 SA, Măgurele.



**Programul Bursa Universităţii Transilvania pentru mobilitate
internaţională Competiţia 2017**

**Granturi pentru tineri cercetători
Competiţia 2017/8039/14.07.2017 valoare 22500 lei**

Brevete



**Medalie de aur
EUROINVENT 2023**



**Medalie de aur
EUROINVENT 2015**



**Medalie de argint
EUROINVENT 2017**



Cursuri

- Tehnologia materialelor anul I ISI +IS
- Toleranţe şi control dimensional II ISI +IS
- Prelucrări mecanice III ISI +IS
- Tehnologii curate de sudare anul II ISMA
- Surse moderne de sudare anul I ISMA



Laboratoare

- Tehnologia materialelor
- Toleranţe şi control dimensional
- Prelucrări mecanice
- Tehnologii curate de sudare
- Surse moderne de sudare
- Ştiinţa materialelor
- Tehnologii şi echipamente de control





BIII – Planuri de evoluţie şi dezvoltare a carierei

Termen scurt (2024-2025)

- ❖ Înscrierea în şcoala doctorală interdisciplinară
- ❖ Un doctorand
- ❖ Avansare la gradul de prof. univ.



Termen lung (2025- ...)

- ❖ Realizarea unei propuneri de proiect de cercetare
- ❖ Publicarea a minim unui articol pe an cu F.I. > 0.5
- ❖ Câştigarea unui grant de cercetare
- ❖ Publicarea de brevete de invenţie





BIII – Planuri de evoluție și dezvoltare a carierei

Planuri / teme de cercetare

2024...

- ❖ Procesarea termomecanică a materialelor avansate în lichid
- ❖ Sudarea cu laser a aliajelor din titan
- ❖ Sudarea cu laser și pulbere a materialelor eterogene cu compatibilitate metalurgică scăzută



Test preliminar privind înălțimea maximă a coloanei de apă care poate fi utilizată la procesarea cu apă





Proiecte de cercetare

1. Advanced Metallic Materials for New Generation Nuclear Power Plants, 4R, NUCLEARMAT (PCCA 243/2014, as **Principal investigator / Project responsible**)

Lucrări publicate

1. Stanciu E.M., Pascu A., Tierean M.H., Roata I.C., Voiculescu I., Hulka I., Croitoru C., Dissimilar Laser Welding of AISI 321 and AISI 1010, Technical Gazette, ISSN 1330-3651, Vol. 25/No. 2, 2018, I.F. 0.72.
2. Stanciu E.M., Pascu A., Roata I.C., Croitoru C., Tierean M.H., Laser welding of dissimilar materials, Materials Today-Proceedings, 19, pp 1066-1072, ISSN 2214-7853, 2019.
3. Stanciu E.M., Pascu A., Gheorghiu I., CMT Welding of Low Carbon Steel Thin Sheets, IOP Conference Series: Materials Science and Engineering, 209, 2017, 012051
4. Stanciu E.M., Pascu A., Roată I.C., Croitoru C., Tierean M., Mirza Rosca J., Hulka I., Solar radiation synthesis of functional carbonaceous materials using Al_2O_3/TiO_2 -Cu-HA doped catalyst, Applied Surface Science 438, pp 33–40, 2018, ISSN 0169-4332, I.F. 5.15, **Q1**.
5. Stanciu E.M., Pascu A., Roată I.C., Iatan C., Moldovan E.R. and Tierean M.H., Millisecond pulsed laser welding of AISI 316 stainless steel, IOP Conf. Series: Materials Science and Engineering, IOP Publishing, 1251, 2022, 012012
6. Stanciu E.M., Pascu A., Croitoru C., Roata I. C., Cristea D., Tierean M.H., Hulka I., Petre I.M., Mirza Rosca J. C., Functional Surfaces via Laser Processing in Nickel Acetate Solution, Materials, 2023, 16, 3087, I.F. 3.4, **Q2**.
7. Voiculescu, V. Geanta, E.M. Stanciu, D.A. Jianu, C. Postolache, V. Fugaru, Effect of Irradiation and Temperature on Microstructural Characteristic of FeCrAl Alloys, Acta Physica Polonica A, 134(1), pp 116-118, 2018, I.F. 0.725
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9. Moldovan E.R., Doria C.C., Ocana J.L., Baltas L.S., Stanciu E.M., Croitoru C., Pascu A., Roata I.C., Tiereanu M.H., Wettability and Surface Roughness Analysis of Laser Surface Texturing of AISI 430 Stainless Steel, Materials, 2022, 15(8), 2955, I.F. 3.4, **Q2**.
10. Geanta V., Voiculescu I., Tenciu D., Baschir L., Stanciu E.M., Pascu A., Effect of laser processing on the microstructure of the FeCrAl alloys, Journal of Optoelectronics and Advanced Materials, 2020, 22(7-8), pp 411-418, I.F. 0.63



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