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Romania – Republic of Serbia
IPA Cross-border Cooperation Programme

ACTIVE PRECURSORS USED TO MANUFACTURE BRAZING RODS

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Objectives

- To increase the flexibility and resistance of technological characteristics for coated rods used at brazing, obtained from standard blanks by adding in the deoxidizing layer powder materials that have proprieties which improve the melts fluidity.
- Production cost reduction by diminishing the expensive materials.
- Raising the brazing productivity.
- Developing couples, standard coated rod- powder precursor- deoxidizing coat, that have high performance regarding the depositions fluidity and deoxidizing capacity of the mixture precursor-deoxidizing flux.
- Manufacturing copper alloy powders that have compact grains, through casting and grinding procedures.

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Developing precursors in the flame oven

- To melt the precursors in the flame oven we used a ceramic metal pot, that has basic character, it was embedded in insulating case made of a steel support and an insulator made out of burnt alumina, reinforced with refractory concrete; a burner with liquefied petroleum gas, LPG, that has two gas feeding paths, at liquefying pressure, with compressed water feeding path at 12 bar pressure and a cooling system with water at 3.5 bars and max. 40^0C.

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CIF Melting

- To melt complex alloys type Cu-Sn-Si-P, we used a CIF heated oven and to accomplish the experimental stand we used a graphitic pot, an inductor made from a copper tube, a high frequency generator, a water cooling system and an argon tank.

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Developing the precursors in void in the electric arc oven

- The experimental recipes are placed on the vacuum chamber tray.

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Achieving the powder precursors

- The powder was accomplished in two stages:

The first stage was individual grinding, we crushed them between two jaws on a hydraulic press of 20 Tof. The grinding was accomplished through successive hits until we obtained particles with exterior dimensions of max. 10 mm.

- Grinding in a planetary mill was the second stage, determined based on the rule 1/1, namely 50% load and 50% empty nest. The grinding was done with variable speed, so in the first stage we made an shock grinding – 120 minutes – and in the final stage the speed was raised until we achieved a autogenously grind, by friction, at 2800 rot/min.

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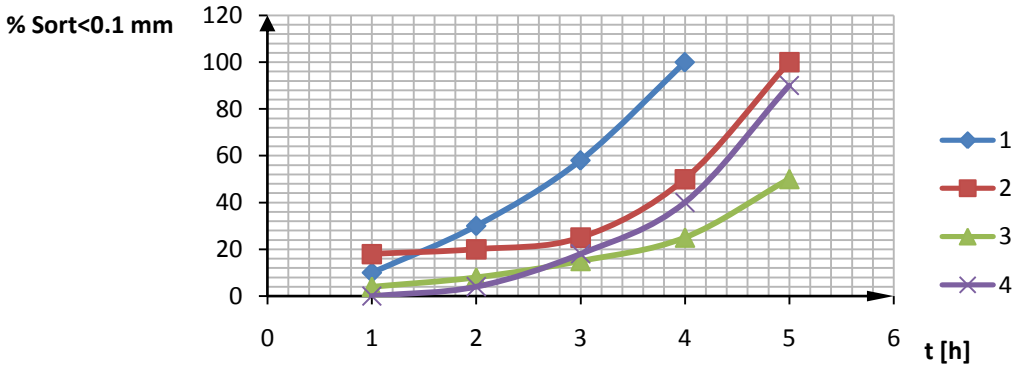
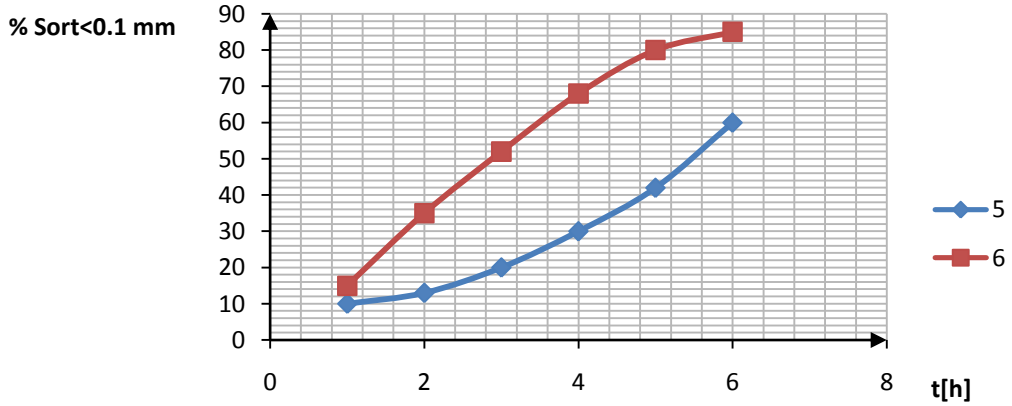
Grinding diagrams



Precursors type Cu-Sn (1); Cu-Sn-P3 (2); Cu-Sn-P5 (3); Cu-Sn-P-Si (4);



Silver precursors type Cu-Sn: (5)Cu-Sn-Ag3-P; (6)Cu-Sn-Ag9-P.

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The chemical composition of the developed precursors

Precursor type	The elemental chemical composition in mass %					
	Cu	Sn	P	Si	Ag	Other
Cu-Sn	50,66	48,32	-	-	-	1,2
Cu-Sn-P3	53,71	42,86	3,48	-	-	0,09
Cu-Sn-P5	49,16	45,21	4,52	-	-	1,11
Cu-Sn-P-Si	80,28	14,63	1,95	2,88	-	0,86
Cu-Sn-Ag3-P	55,62	37,48	3,75	-	3,75	0,02
Cu-Sn-Ag9-P	48,75	37,50	4,30	-	9,30	0,13

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Hardness tests

Sample Mark	Tested Area	Vickers Hardness – HV5 Individual Values							Estimator ΔHV5*(%)
0	1	2							3
A1	MB	280	306	232	232	223	280	241	27.12
A2	MB	353	362	349	321	336	271	303	25.13
R1	MB	61	51	56	56	50	53	-	18.03
R2	MB	51	52	50	55	54	50	-	9.09

- *ΔHV5 – Local hardness estimator determined with the formula:
- ΔHV5 = [(HV5max – HV5min)/ HV5max]·100[%]
- were:
- -HV5max. is maximum hardness in a area,
- - HV5min. is minimum hardness in the same area.
- If ΔHV5 ≥ 50 %, in the examined area increased local hardening occurs, the risk of fragile cracking is high.

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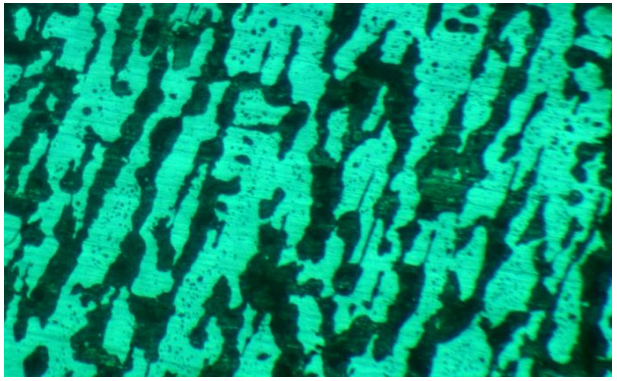
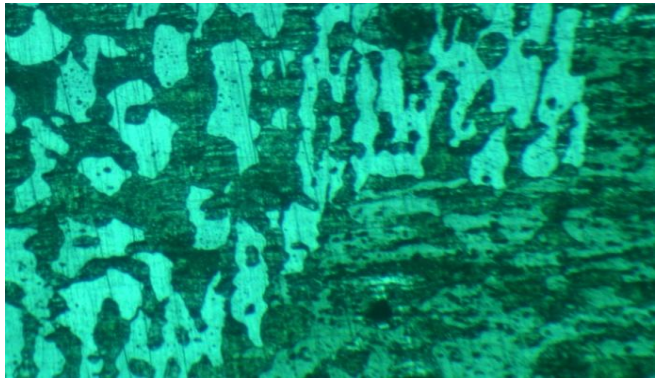
Metallographic structures, microscopic examinations

Sample Mark	Microscopic Examination [100×]		Investigated areas	Chemical attack reactive
	Components SR 5000-97	Defects STAS 5500-74		
0	1	2	3	4
A1	Solid solution α rich in copper and fine oxides	None that can be observed	MB	E1
A2	Solid solution α rich in copper and fine oxides	None that can be observed	MB	E1
R1	Solid solutionα rich in copper and particles with evenly distributed oxides	None that can be observed	MB	Ammonia Chloride Cupric
R2	Solid solution α rich in copper and particles with evenly distributed oxides	None that can be observed	MB	Ammonia Chloride Cupric





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Conclusions

- The studies and research accomplished in order to develop active precursors, under the form of metallic powders have led to establishing manufacturing recipes, namely to develop laboratory manufacturing technologies for small series.
- The results selectively presented are part of research done for the PhD. School from “Politehnic” University Timisoara and ISIM Timisoara.

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Thank you!

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