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# Thermal and Structural Analysis of the Ternary Eutectic Alloys in Cu-Al-Ag and Cu-Al-Au Systems

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## ***Introduction***

Research done to investigate shape memory alloys of different systems has included alloys of the ternary Cu-Al-Ag and Cu-Al-Au systems, too.

These alloys are characterized by biocompatibility what makes them convenient materials for different applications in medicine and bioengineering.



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## ***Experimental***

Alloy samples preparation - induction melting of the starting metals in graphite crucibles under argon atmosphere, (constituent metals purities : Cu – 99.99%, Al – 99.99%, Ag – 99.99%, Au – 99.99%.

The phase transformation temperatures of the as-cast alloy samples - DTA method using NETZSCH STA 449F1 Jupiter instrument under following conditions: argon atmosphere, heating rate 10<sup>0</sup>C/min, reference material – alumina.

Microstructure analysis:

- optical microscopy, (magnification 200 and 500)
- scanning electron microscopy using SEM TESCAN VEGA TS 5136MM instrument with simultaneously analyzing of the chemical composition by energy dispersive spectroscopy (Bruker spectrometry) – SEM/EDS



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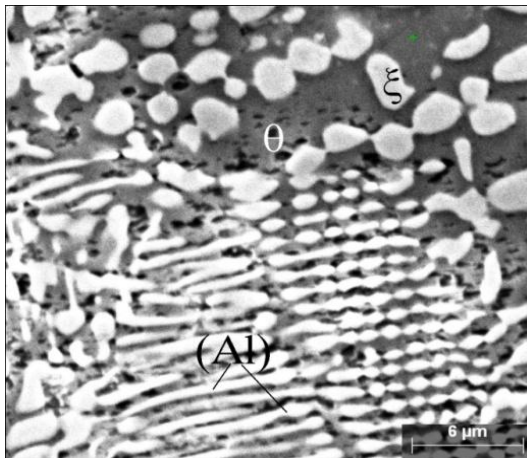
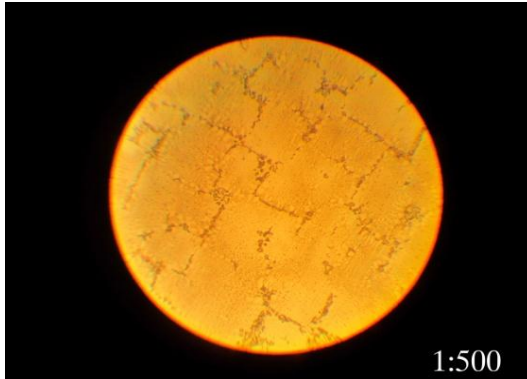
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## Results



## Cu-Al-Ag system

*Sample alloy  $Cu_{20}Al_{60}Ag_{20}$*

Microstructure of eutectic alloy  $Cu_{20}Al_{60}Ag_{20}$  consists of three phases:

- Dark phase corresponds to  $\theta$  phase
- Bright grey grains represent primary crystallized grains of  $\xi$  phase
- Light lamellar grains present aluminum based solid solution (Al), formed during eutectic solidification.



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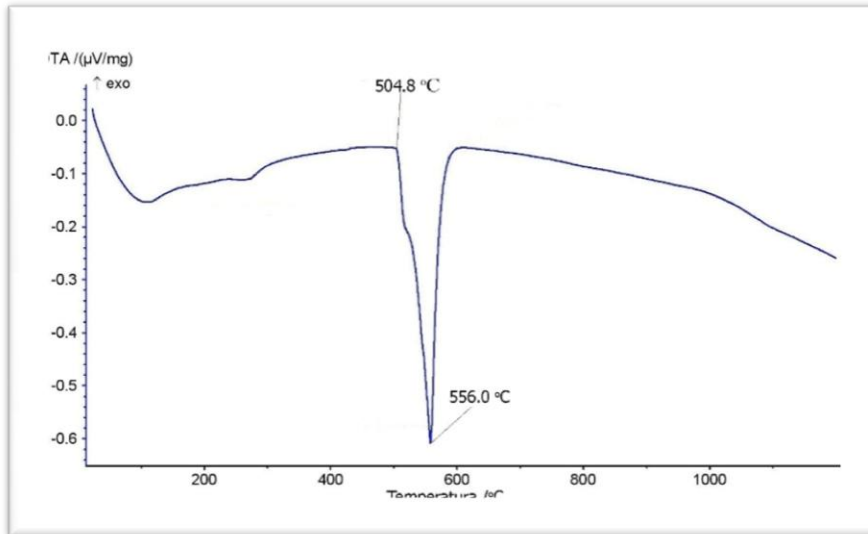
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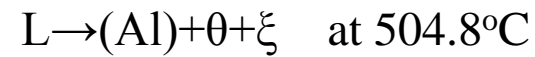
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Ternary eutectic reaction:



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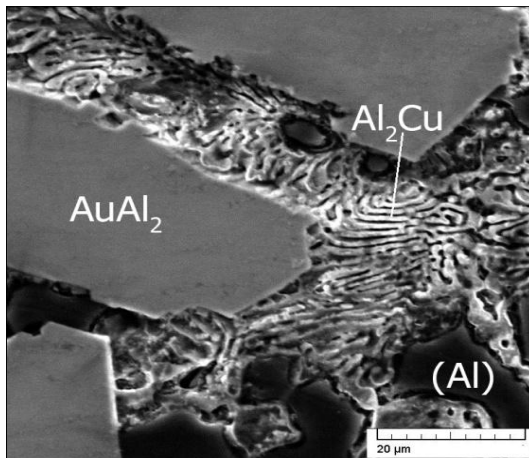
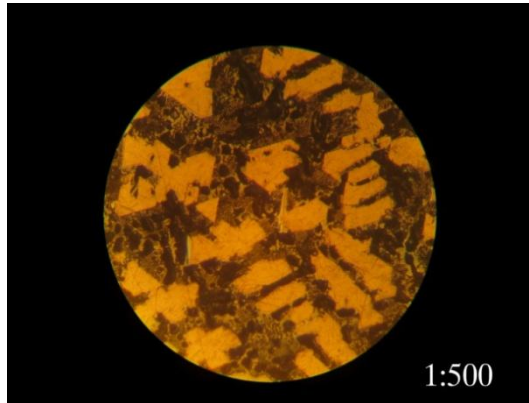


## Cu-Al-Au system

### *Sample alloy $Cu_{10}Al_{80}Au_{10}$*

Microstructure of eutectic alloy  $Cu_{10}Al_{80}Au_{10}$  consists of three phases:

- Dark phase – solid solution based on aluminum, (Al)
- Bright grey grains - represent primary crystallized grains of intermetallic compound  $AuAl_2$
- Light lamellar grains – intermetallic compound  $Al_2Cu$  formed during eutectic solidification.



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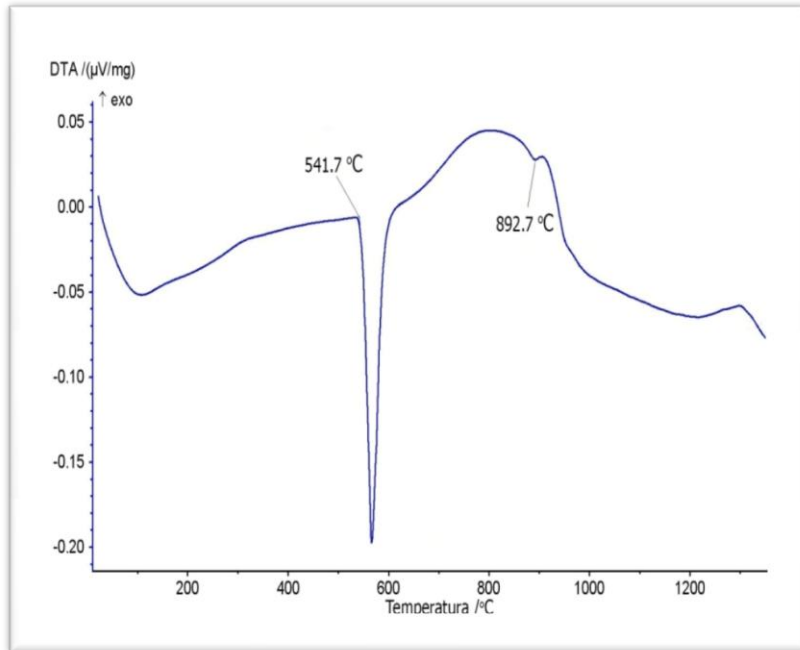
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# Thank you for your intention!



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