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Fabrication of Co-Cr alloys for biomedical applications by implementing rapid solidification

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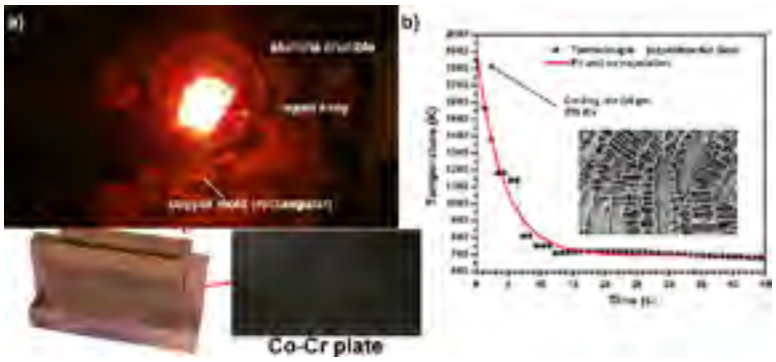
Statement of the Problem: It is well known that there is a lack of innovation with respect to solidification processes on Co-Cr based alloys for biomedical applications (e.g. dental implants and permanent stents). Moreover, the most conventional technique to obtain Co-Cr biomedical devices is the investment casting process which involves inherent microstructural defects as a high percentage of interdendritic segregation and several precipitates distributed along the microstructure. All these features results in a decrement of the mechanical properties in Co-Cr alloys used in the biomedical field.

Methodology & Theoretical Orientation: High purity cobalt (99.99 %) and chromium (99.99%) were used as starting metals for processing the experimental Co-Cr alloy. Rapid solidification regime was confirm trough the temperature profile recorded using an Amprobe TMD90A digital thermometer with R type thermocouples inserted into a ceramic sheath, embedded in the cooling metal.

Findings: Rapid solidification promotes the elimination of interdendritic segregation and, in consequence, a diminution of precipitates can be achieved. On the other hand, a control in the γ-Co, FCC ↔ε-Co, HCP transformation was reached. The above microstructural and crystallographic features are related with the improvement on the mechanical properties and corrosion resistance on Co-Cr alloys. Theoretical solidification models were used to understand several features of rapid solidification regime imposed on Co-Cr alloys. These consist in a competitive growth analysis to predict the growth temperature limits of the eutectic constituent and the solid solution for the alloy system.

Conclusion & Significance: Nowadays, Co-Cr alloys still are very important in the biomedical field. For this reason, it is important and necessary to propose alternative and innovative solidification procedures to fabricate Co-Cr biomedical devices. Consequently, we can improve the mechanical and corrosion properties significantly through a microstructural control.



Biography

A L Ramírez-Ledesma has her expertise in rapid solidification techniques for Co-Cr alloys and Zn based alloys. Her innovative and non-conventional solidification techniques create a newline of investigation for improving their performance in the biomedical field. Moreover, her collaboration with medical institutions (e.g. National Institute of Cardiology (INC, México, Ciudad de México) will allow the technological development of cardiovascular prosthesis which can be easily accessible for Mexican population. She was awarded with the Conacyt Scholarship for her Doctoral studies in Materials Science and Engineering Program (UNAM) at Materials Research Institute (UNAM).

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