Cobalt-Chromium Solidification Modeling for Use in Additive Manufacturing

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Introduction

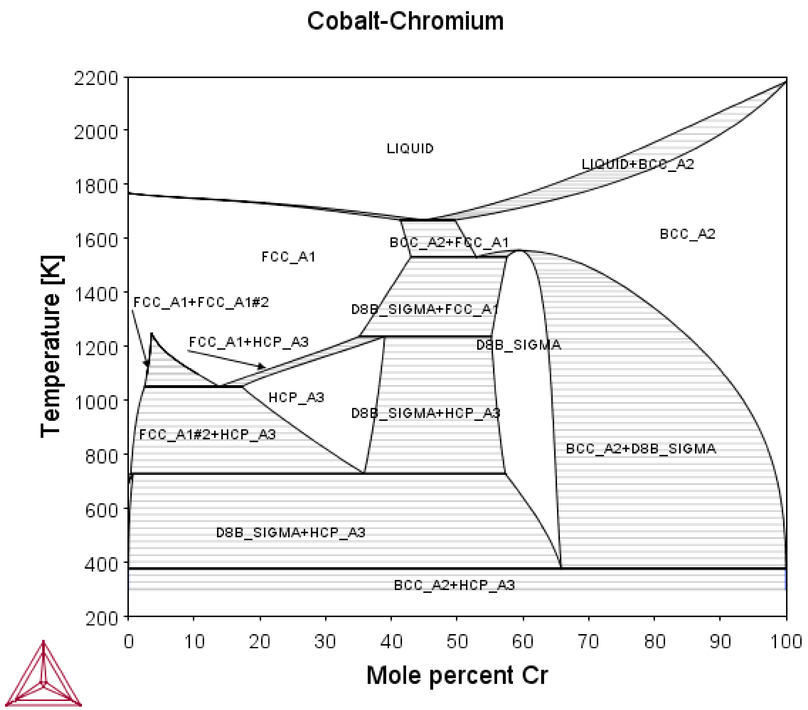
Cobalt-Chromium is being used to make medical and dental implants due to its biocompatibility. Additive manufacturing is used to make these parts in order to make them specific to the patient. This research project looked at modeling and understanding how Cobalt-Chromium solidifies to prevent defects.

Materials and Methods

A software by the name of Termocalc was used to predict the phase diagram of Cobalt-Chromium. This helps us to understand the phases and structures of a cooled metal.

Results

The diagram to the Right is the result of the modeling done. This phase diagram displays what microstructure forms based on the temperature of the metal and the mole percent composition. This diagram helps predict how rapid solidification in metal additive manufacturing would affect the solidification and phases formed in the part. This is important for the longevity of the piece as well as identifying possible defects and obtaining the desired properties.



Conclusions

This outcome is relevant to the additive manufacturing community for understanding how rapid solidification affects the phases and microstructure of cobalt-chromium. With this knowledge, pieces with fewer microcracks, micropores, or defects can be made.

Future work is centered around two directions. When labs open up for study again, rapid solidification will be experimentally tested using Electro-Magnetic Levitation. Additionally, ternary diagrams will be made using this method for Cobalt-Chromium-Molybdenum and Cobalt-Chromium-Tungsten.

Literature Cited

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Acknowledgments

I would like to thank Professor Douglas Matson in the Mechanical Engineering Department at Tufts University and PhD student Evan Baker.

Further Information

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