Materials Science and Engineering Department

Spring Seminar Series

Metallurgy of Superalloys

--- Application, Classification, Processing, Property and Design

Dr. Ning Zhou
Carpenter Technology Corporation R&D Center
Reading, PA 19608

May 15, 2024
11AM-12PM | Hill Seminar Room (LeBow 240)

Superalloys represent a class of high-performance materials capable of withstanding the extreme conditions encountered in modern industrial applications. The combination of their high temperature mechanical properties and oxidation/corrosion resistance makes them indispensable for advancing technology in aerospace, energy, and other critical sectors. Starting with the applications and classification of superalloys, this talk will be focusing on the processing technologies of various types of superalloys, ranging from traditional cast and wrought alloys to advanced techniques like powder metallurgy for turbine disk alloys and investment casting for single crystal turbine blade alloys. Furthermore, a considerable emphasis will be placed on additive manufacturing, a pivotal aspect of new processing techniques. In particular, the advantages and challenges associated with manufacturing complex superalloy components using laser powder bed fusion. Moreover, by highlighting some distinctive mechanical behaviors of superalloys attributable to their intermetallic strengthening phases, this talk will provide insights into the selection of existing alloys for specific applications as well as designing new ones tailored to precise requirements.

Ning Zhou is a high temperature alloy metallurgist in the alloy design group at Carpenter Technology Corporation R&D center. He obtained his Ph.D. in Material Science and Engineering from The Ohio State University in 2008, focusing on creep and directional coarsening in single crystal Ni base superalloys. After completing his post-doctoral research on deformation mechanisms of powder metallurgy (PM) disk superalloys at OSU, he joined General Electric's Global Research Cetner in Niskayuan NY in 2011 as a material scientist. There, he contributed to the development of the next-generation turbine blade and disk alloys for GE Aviation. In 2017, Dr. Zhou joined Carpenter Technologies and led the development of GammaPrint®-1100, a recently commercialized high gamma prime superalloy optimized for additive manufacturing. He has over 20 years of research experience on superalloys with more than thirty publications and five granted US patents.

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