

You are cordially invited to attend this seminar to be held on

Monday, May 28th, 10:00

Room 406, Wolfson Mechanical Engineering Building

SOLIDIFICATION DURING SELECTIVE LASER MELTING

Prof. Zhan Chen

Department of Mechanical Engineering, Auckland University of Technology, NZ

Powder-bed fusion selective laser melting (SLM) is the major form of metal additive manufacturing. The additive feature of SLM allows for parts of high shape complexity to be made but the liquid to solid transformation in the tiny and rapidly moving melt during SLM can result in microstructures that are not desirable for functional parts. Thus, how grain growth direction and cell/dendrite size may be affected and possibly be controlled by SLM parameters are important to be understood. In this presentation, firstly, our study on modes of solidification during SLM of metallic alloys will be described. How the major mode of solidification has limited the application of SLM to wider industrial alloys will be discussed. Secondly, the effect of increasing laser power on heating mode and thus the shape of melt track will be explained. The explanation will extend to the significance of the effect of track shape/size on grain size and growth direction. Thirdly, the extensive measurement of cell/dendrite size and track geometry related growth rate combining the use of primary cell/dendrite spacing model for the calculation of thermal gradient and cooling rate will be presented. These estimated thermal quantities will be plotted in solidification map to estimate how thermal condition may need to be adjusted for the more favorable solidification mode.

Professor Zhan Chen received his BE in materials engineering from the (now named) Central South University in China in 1982, before completing his ME in 1985, and PhD research in 1989 at the University of Auckland. He then spent ten years in Australia conducting research on materials processing; three years with the then Pasminco Research Centre; and seven years with the Commonwealth Scientific and Industrial Research Organization (CSIRO). During that period, he worked in the areas of squeeze and high pressure die casting, semisolid forming and mechanical properties of aluminium and magnesium alloys. On his return to NZ in 2000, Professor Chen joined the Dept. of Mechanical Engineering at AUT and has been teaching subjects on engineering materials and manufacturing technologies/processes at various levels. Throughout his time at AUT he has conducted research with his students on thermomechanical related processes, friction stir welding/processing (FSW/P) of various alloys and machinability of difficult-to-cut materials, and on welding metallurgy. For the last four years, Professor Chen has been working on metal additive manufacturing (AM), both selective electron beam melting and selective laser melting technologies. In this work, he examines how the complex thermal conditions and melting dynamics affect the tracks, microdefects and microstructures formed during AM and the subsequent mechanical properties of the AM materials.