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Optimization of mechanical properties for a gear steel alloy for aero-engine applicationsZakaria Abdallah¹, M R Bache¹, K M Perkins¹, M Rawson² and J Hetherington²¹Swansea University, UK²Rolls-Royce, UK

The characterization of steel alloys, candidates for employment as a gear material for future gas turbine aero-engine, will be described in the present study. Comparative studies were initially performed on seven potential steel alloy systems, considering a range of properties including mechanical behavior, the forgeability of the alloy, the depth and carbon content of the carburized layer alongside the Prior Austenite Grain (PAG) size. A major objective was to obtain a fully martensitic microstructure through quenching, deep freezing and tempering treatment of the chosen steel alloy. Specifically, the microstructures generated from various heat treatments alongside carburizing trials to improve the surface wear resistance will be characterized through metallographic and hardness assessments. The inspection methods employed to quantify the amount of carbon in the carburized layer included Wavelength Dispersive Spectroscopy (WDS) alongside electron probe micro analysis (EPMA). Flow stress was evaluated using Right Circular Cylinder (RCC) specimens tested under compression across a wide range of temperature and strain rate, with the associated thermo-mechanically driven phase transformations studied using Differential Scanning Calorimetry (DSC) and dilatometry, all supporting DEFORM[®] process modeling.

Biography

Zakaria Abdallah is the Principal and Lead Research Officer of Fatigue and Fracture in the Steel and Metals Institute at Swansea University, UK. He also worked at the Rolls-Royce University Technology Centre at Swansea University. He has worked as a Consultant for various industries, e.g. Airbus, TIMET, ETD, Rolls-Royce, in the UK within Swansea Materials Research and Testing (SMaRT) Ltd. he leads, or has led, several modules at Swansea University, e.g. advanced materials, fundamental of materials, maths for materials engineers, design against fatigue, etc. He has a very good track record of publications in internationally-recognized and peer-reviewed journals alongside international conferences and open access books. His research interests include steel and metals, composite materials, materials characterization, creep and fatigue, life predictions of materials, thermo-mechanical testing and heat treatment optimization.

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