

DEVELOPMENT OF X-RAY INSPECTION TECHNOLOGY FOR TURBINE BLADES

Huapeng Huang, Alex Verchinine, Matthew Cusack, and Walter Gibson
X-ray Optic Systems, Inc.
15 Tech Valley Drive
East Greenbush, NY 12061

Abstract

Directionally solidified (DS) and single crystal (SX) nickel superalloys are commonly used in turbine blades for high performance aircraft and space propulsion engines as well as land-based, high-efficiency power generating plants. The casting of these parts does not always insure perfect crystal grain orientation that is critical for performance under the maximum high temperature conditions. Recent engine failures and aircraft mishaps have made imperative efficient and direct measurement of grain orientation in aircraft turbine blades. There is no existing method to nondestructively measure grain orientation across the entire turbine blade. In this presentation, we will report on development of a compact, low power, focused beam x-ray diffraction analyzer that can directly and nondestructively measure turbine blade grain orientation for each individual grain in factory production lines or in the field. This is made possible by using proprietary polycapillary focusing x-ray optics; a highly stable, reliable, low power X-Beam system; and a novel approach to determine grain orientation by measurement of diffracted beam directions from selected crystal planes.