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COMPUTATIONAL AND STATISTICAL ANALYSIS FOR JOINING OF EXOTIC ENGINEERING MATERIALS – A CASE STUDY

Rajakumar Selvarajan✉,

Associate Professor,
Centre for Materials Joining and Research (CEMAJOR),
Department of Manufacturing Engineering, Annamalai University, Annamalai nagar, Chidambaram, Tamilnadu.

Abstract

In the modern era of manufacturing, utilization of interesting materials with enhanced properties is being executed into critical applications. The materials that are to be into service needs a critical evaluation before utilization; the actual working environment is assumed in case of numerical or simulated environment. Some of the material merely used for critical applications and have been evaluated with statistical and computational methods are discussed below.

The statistical evaluations conducted over some aero-engine materials like titanium (Ti-6Al-4V) utilized in blisks were optimized for their multiple responses using Response Surface Methodology (RSM), a statistical tool predicted about 95 % to the experimental value. The corrosion rate of aerospace Aluminum 7075 alloys was predicted by design of experiments (DoE) statistical methods. Similarly, the statistical analysis is also performed with AZ31B on diffusion bonding, revealed that bonding temperature was the most influencing process in the joining of AZ31B. Some comparative approaches like RSM and Particle Swarm Optimization (PSO) on aerospace engine materials revealed that the process with the maximum number of iterations developed close to the optimized value predicted much accurate results.

In computational method of evaluation with modelling software on the horn of ultrasonic metal welding machine made of tool steel. The nodal analysis performed for the tool for determining the dynamic characteristics of tool under the influence of natural frequencies. The results attained expressed that the maximum dynamic deformation of 168 mm at 7 kHz. The case studies discussed led to improved results when subjected to tests for the real time applications.

Keywords: *RSM; PSO; computation; tailored materials; statistics; numerical analysis*

Corresponding Author Email : srkcemajor@yahoo.com
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