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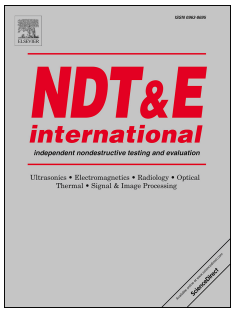

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NON-DESTRUCTIVE INVESTIGATION OF ALUMINUM ALLOY HEMMED JOINTS USING NEUTRON RADIOGRAPHY AND X-RAY COMPUTED TOMOGRAPHY

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Abstract Methods for the non-destructive analysis of aluminum alloy hemmed joints for automotive applications were investigated to visualize the void size, volume fraction and shape within the adhesive fill. These defects can adversely affect the performance of hemmed joints by decreasing fatigue strength and corrosion resistance. Thermal neutron radiography and X-ray computed tomography were applied to visualize the voids. The void fraction within the adhesive fill was determined from the neutron images with the use of an image analysis thresholding method.

Keywords: *neutron radiography, non-destructive testing, hemmed joint, adhesive joint, computed x-ray tomography.*

1.0 Introduction

Over the past two decades, the use of lightweight aluminum (Al) alloys as a substitute for steel in automobile body structures has gradually increased as a result of efforts to meet environmental requirements and improve vehicle performance [1]. Hemming with adhesive bonding is a common joining method for manufacturing automobile body sheet enclosures, including those fabricated from Al alloys. The hemmed joints are produced in a sheet forming process in which the edge of one sheet, referred to as the outer sheet, is bent over the edge of another sheet, the inner sheet [2]. A layer of structural adhesive is laid between the inner and outer sheets to create the required mechanical bond. A three-step hemming operation is illustrated in Figure 1. Typical body sheet enclosures fabricated with adhesive-bonded hemmed joints include engine hoods, trunk lids, door panels and wheelhouses [3].