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Fracture propagation analysis on two component type acrylic adhesive joints

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Abstract

Detailed investigation on fracture toughness and destruction process was made on acrylic adhesive joints. Tapered double cantilever beam (TDCB), end notched flexure (ENF), and lap shear test were measured using acoustic emission (AE) and digital image correlation (DIC). Two types of secondary generation acrylic adhesives (SGA) were compared. Under lap shear and TDCB measurements, cumulative AE energy reflects the difference between elastomer and acrylic composition in existence form observed under transmission electron microscope (TEM) images. The mode 2 energy release rate G_{2c}, was a smaller value than the mode 1 energy release rate G_{1c}, when derived using linear fracture mechanics. Nonlinear effect is necessary to determine an accurate G_{2c} value. The AE source location analysis, performed in an ENF test, detected the relationship between an actual crack length and an AE generation position. The result of this research is useful to understand the fracture process in a SGA bonded joint.

Keywords: Structural acrylics, Metals, Fracture mechanics, Acoustic emission

1. Introduction

Acrylic adhesive has been applied to various industrial products because of its high productivity and excellent mechanical properties [1-6]. Previous to this research, we investigated the effectiveness of acrylic adhesive only on honeycomb sandwich panel application [7-9]. This research expanded the application to general adhesive joint structures. Although there have been research conducted on bonding using high strength acrylic adhesives, there are not many actual cases of this study [10-12]. Our research focused on SGA. SGA has moderate ductility and bonding strength. The ductility and bonding strength depend on the degree of elastomer modification in an adhesive material.