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Effect of Low Temperature on Tensile Strength and Mode I Fracture Toughness of a Room Temperature Vulcanizing Silicone Adhesive

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Current aerospace applications have an increasing demand for strong and reliable adhesive, able to withstand large temperature gradients. The variation of the adhesive's mechanical properties with temperature is therefore one of the factors that must be well understood before safe and reliable adhesive joints can be designed for these applications. The stress strain curve and the toughness properties of an adhesive show strong dependency with temperature for most adhesives, especially near the glass transition temperature. In this work, an experimental procedure is undertaken to evaluate the effect of low temperatures in the adhesive strength and fracture toughness of a high temperature silicone adhesive of the type RTV106. This adhesive has a glass transition temperature around -65ºC. If joints using RTV106 are to operate in below zero temperatures, the knowledge of the adhesive's mechanical properties near the glass transition temperature is extremely important. For this purpose, bulk specimens were manufactured and tested at temperatures above and below the glass transition temperature in order to obtain a strength profile of the adhesive over this temperature range. For the determination of pure mode I fracture toughness, DCB specimens were also tested at temperatures nearing glass transition temperature. Finally, this work also includes some tests to accurately determine the glass transition temperature of the silicone adhesive.