

Fracture response of flexible adhesives across a wide range of temperatures and strain rates

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INTRODUCTION

Adhesive bonding technology offers several advantages, including greater design flexibility, and better load distribution. While higher strain rates can enhance the strength and fracture response of adhesives, their performance may degrade at elevated temperatures. Understanding how loading modes and strain rates influence the mechanical behavior of structural adhesives at challenging temperatures is crucial when designing joints for specific applications. Our research examines the effect of loading modes and strain rates on the property degradation of a flexible adhesive.

METHODS

The fracture energy for a two-component polyurethan flexible adhesive is obtained by mode I and mixed mode (45°) fracture tests. Experimental tests are conducted at -30, 23, 60 Celsius degrees with a chamber completely surrounding an apparatus, enabling to lower and elevate temperature inside to replicate real-world conditions. Loading rates such as 0.2, 200, 6000 mm/min are applied by Instron 8801 servo-hydraulic testing machine to investigate the corresponding strain rates. The fracture energy for Mode II is estimated from those values for Mode I and mixed mode (45°).

RESULTS

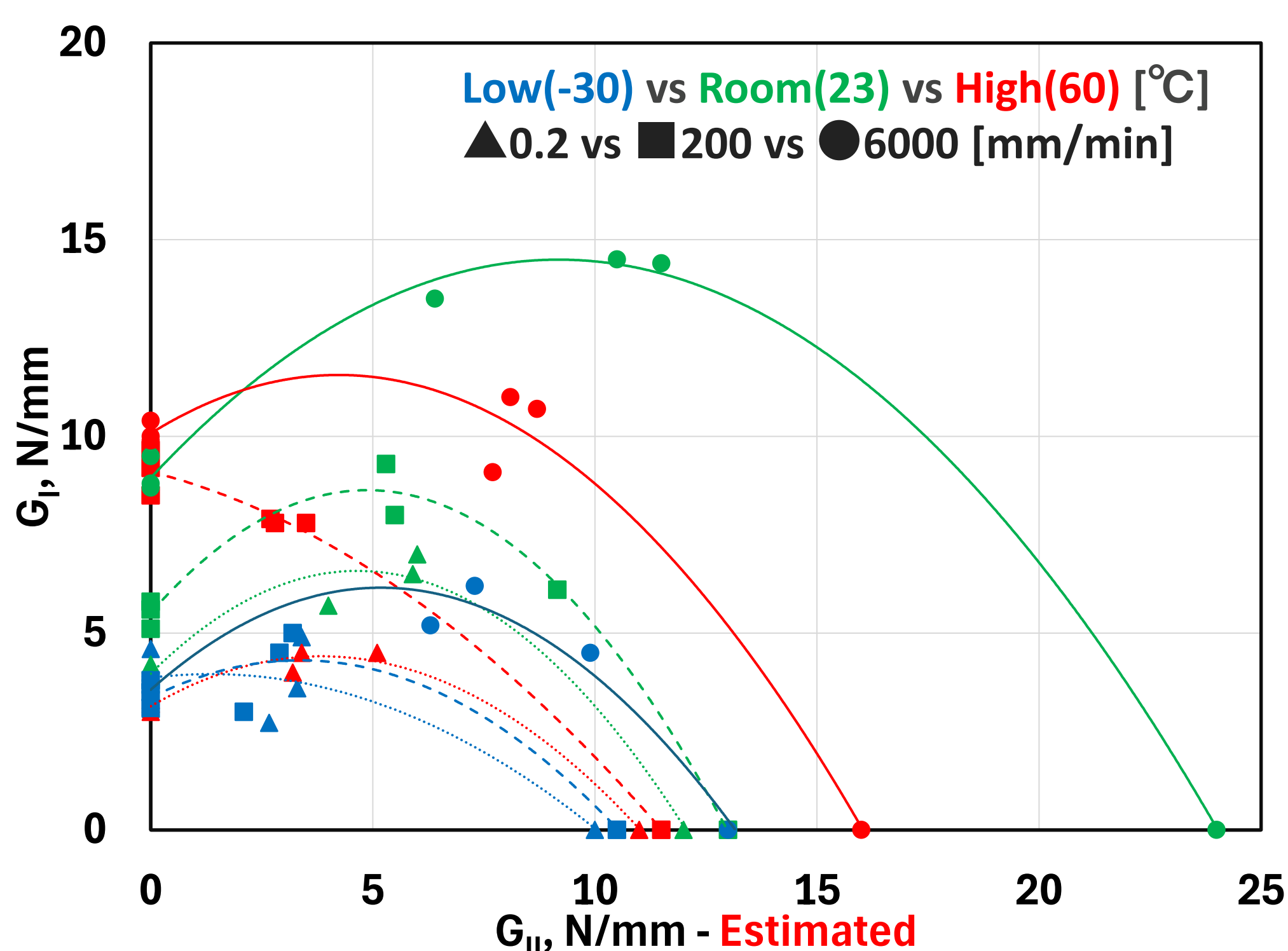


Figure 1– Fracture envelope for 9 conditions.

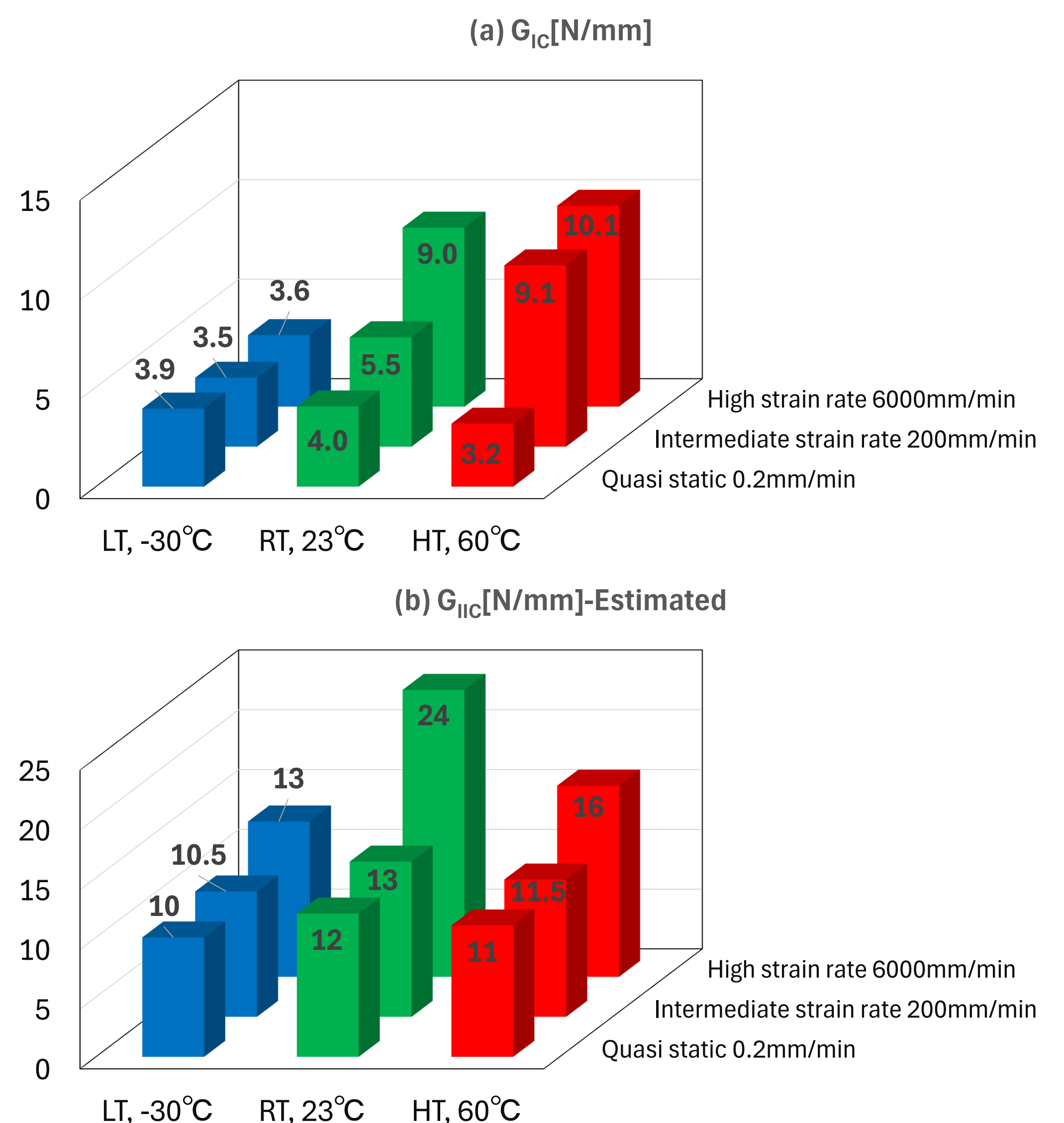


Figure 2 – Fracture energy values. a) Mode I, b) Mode II (estimated).

CONCLUSION

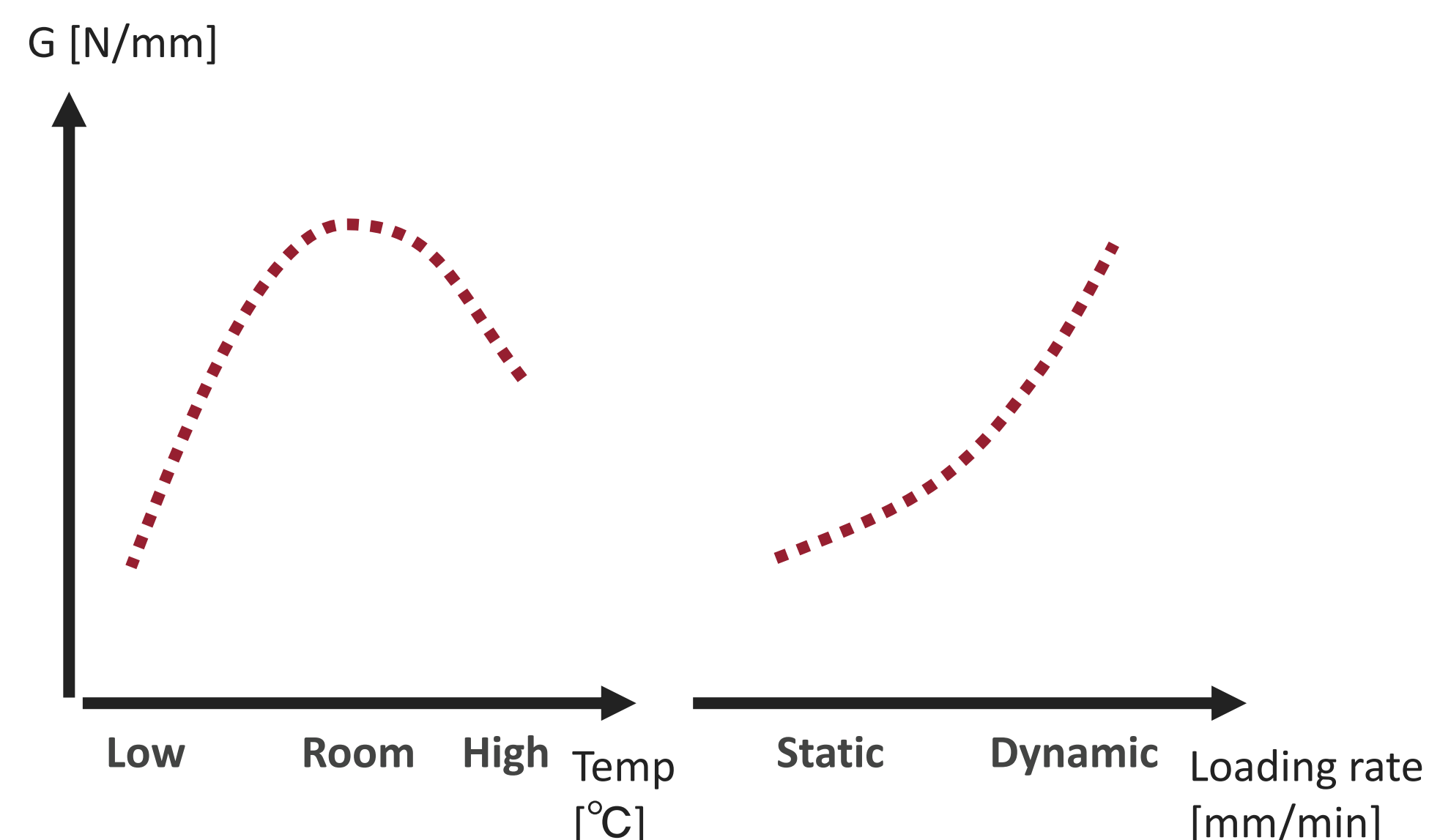


Figure 3 – Temperature and loading rate versus fracture energy, illustrating the trend of fracture energy when varying temperature and loading rate