Computational modeling of a diffusion bonded microchannel under high pressure and temperature

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Abstract

Diffusion bonded microchannels provide significant benefits by reducing space requirements while improving thermal efficiency when used in heat exchangers. In particular, these microchannels have potential to improve efficiencies for combining concentrated solar power with supercritical CO_2 Brayton cycles, where structures operate at high temperatures (760 ˚C) and high pressures (25 MPa). This work uses computational modeling to provide a design space for microchannel geometries under these conditions by using a Representative Volume Element approach.

Additionally, low cycle fatigue results are used to develop a Manson-Coffin relation to predict the effects of plastic loading on the fatigue life of diffusion bonded specimens. Manson-Coffin relations at temperatures of 760 ˚C and room temperature had respective R^2 values of 0.9406 and 0.676, indicating reasonable reliability in results.

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