

fatigue

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Introduction

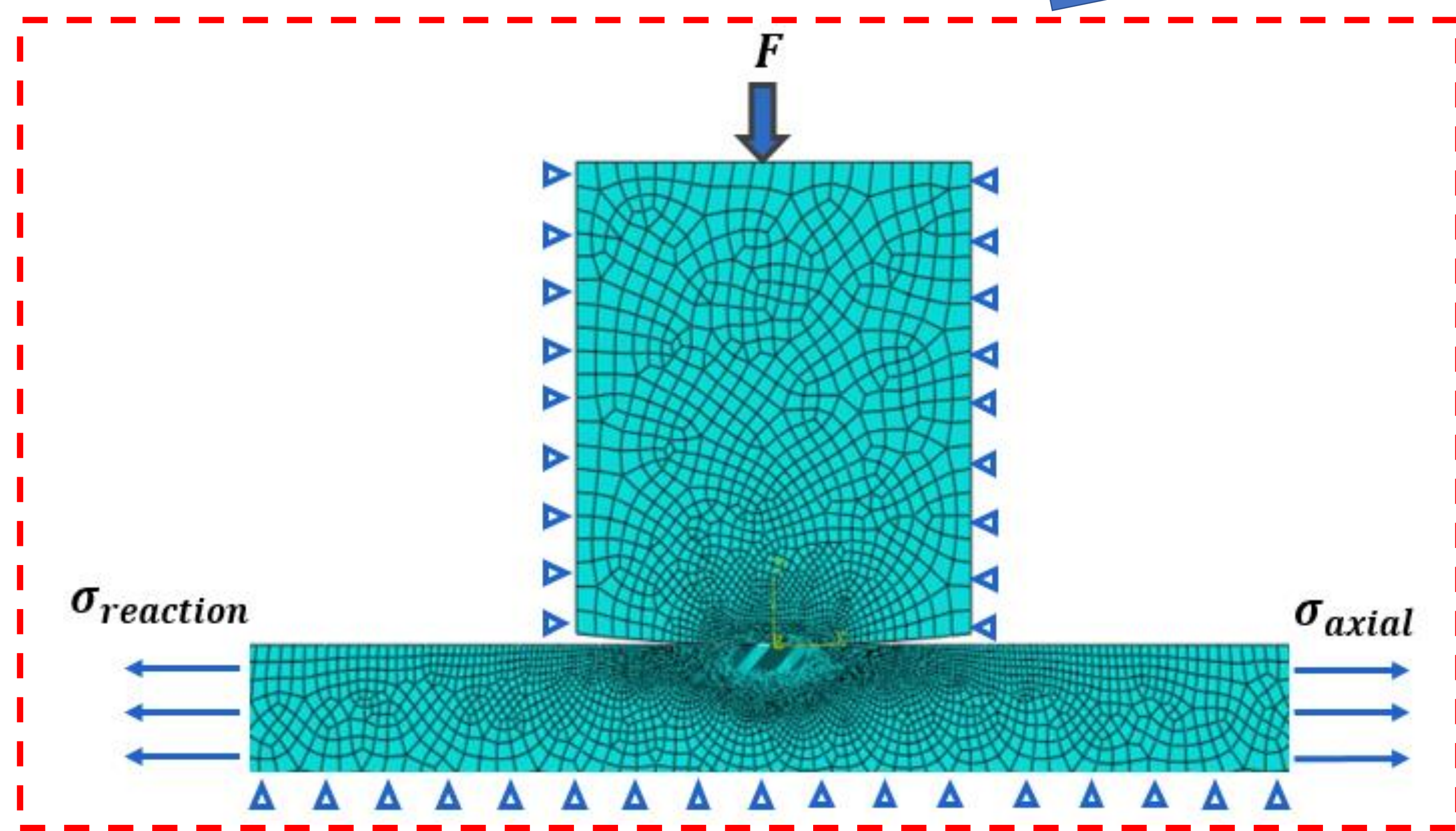
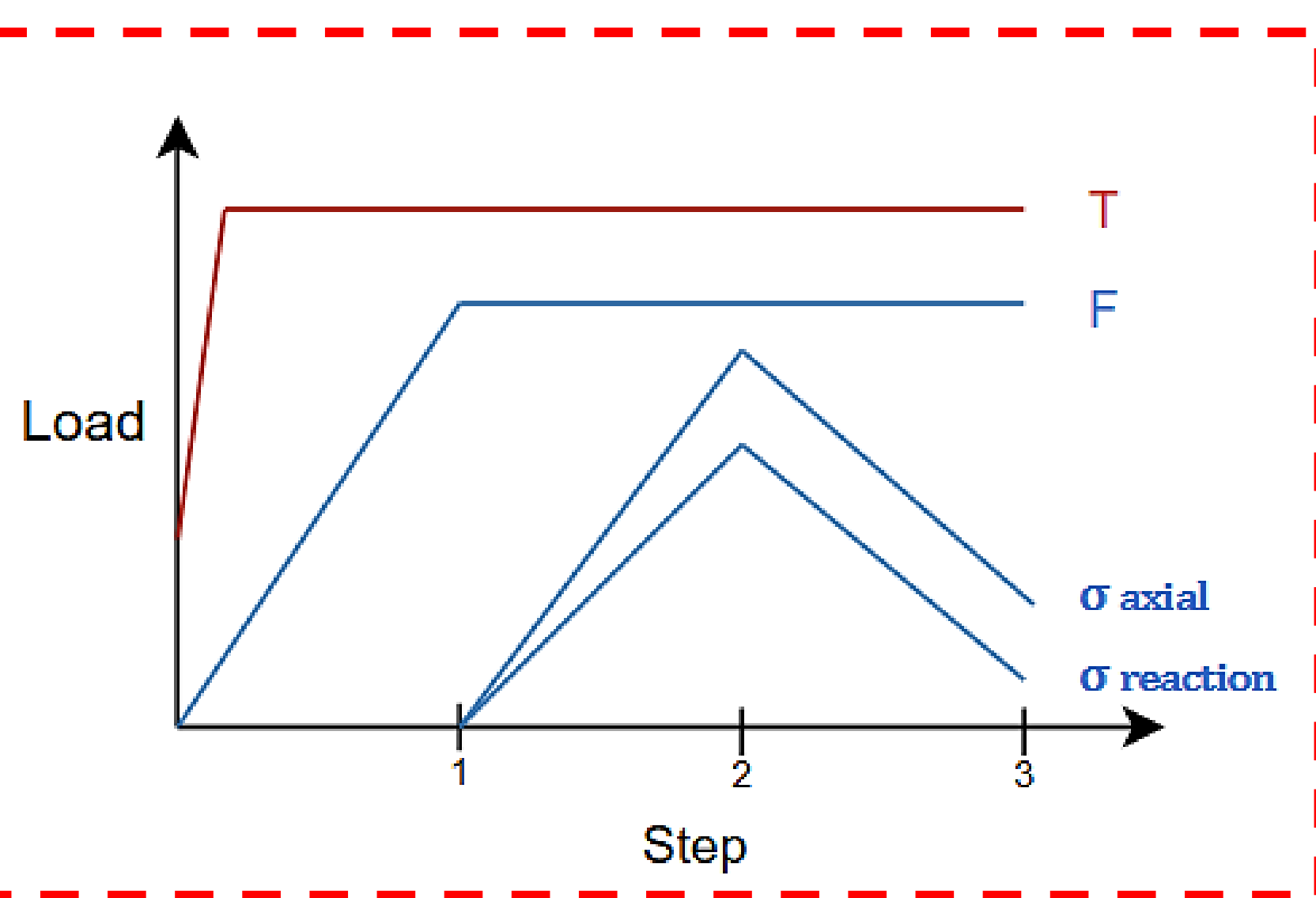
This study presents a 2D finite element model with a cylinder-on-flat configuration to investigate how temperature affects the stick-slip condition, contact pressure distribution, and slip amplitude in Ti-6Al-4V under fretting fatigue. In aerospace applications, Ti-6Al-4V parts frequently operate at elevated temperatures. The analysis is carried out at three representative temperatures, 260°C, 460°C, and 660°C, chosen to span the service range relevant to aerospace components.

Numerical Model

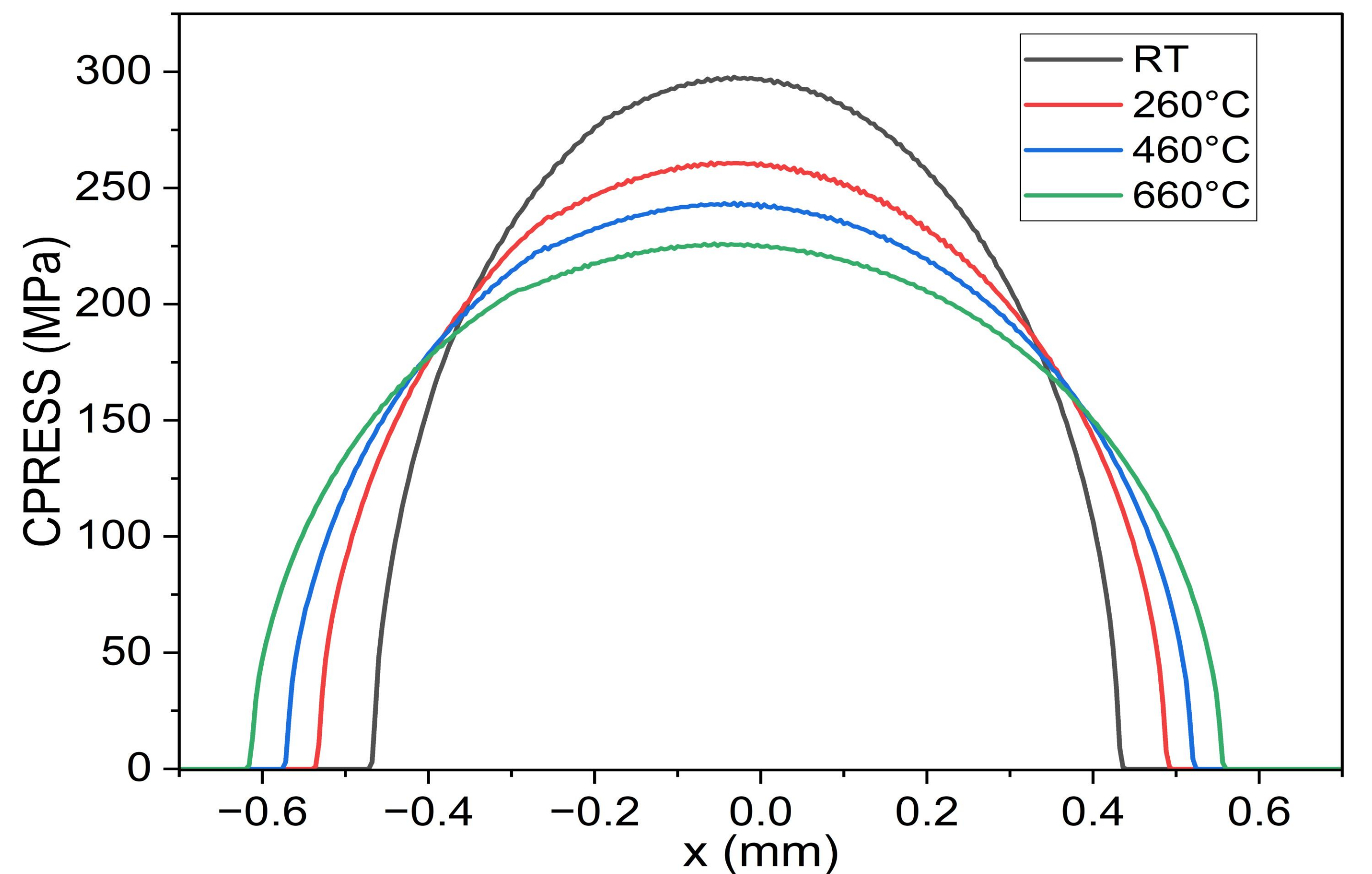
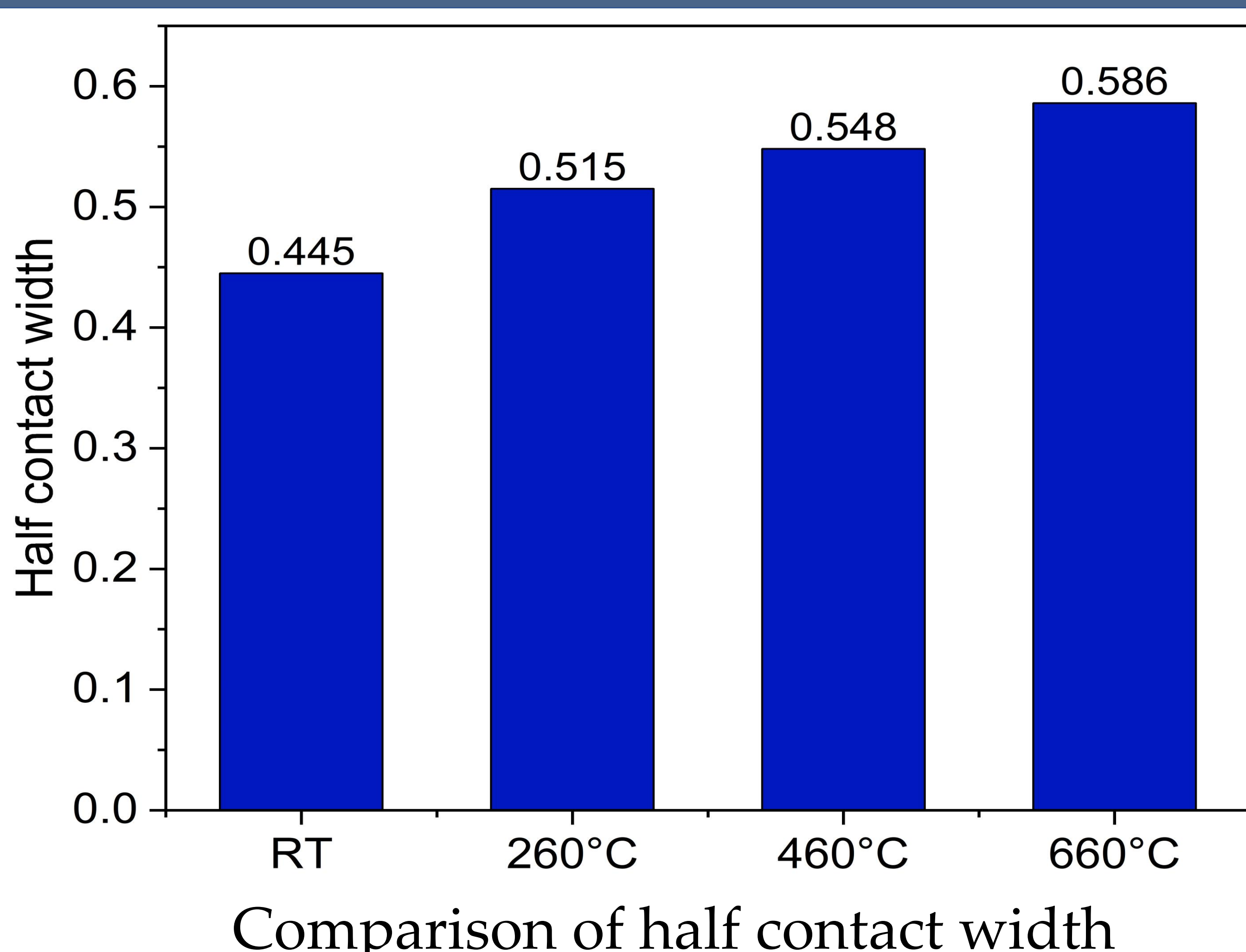
Material
Ti-6Al-4V

Contact Formulation
Lagrange

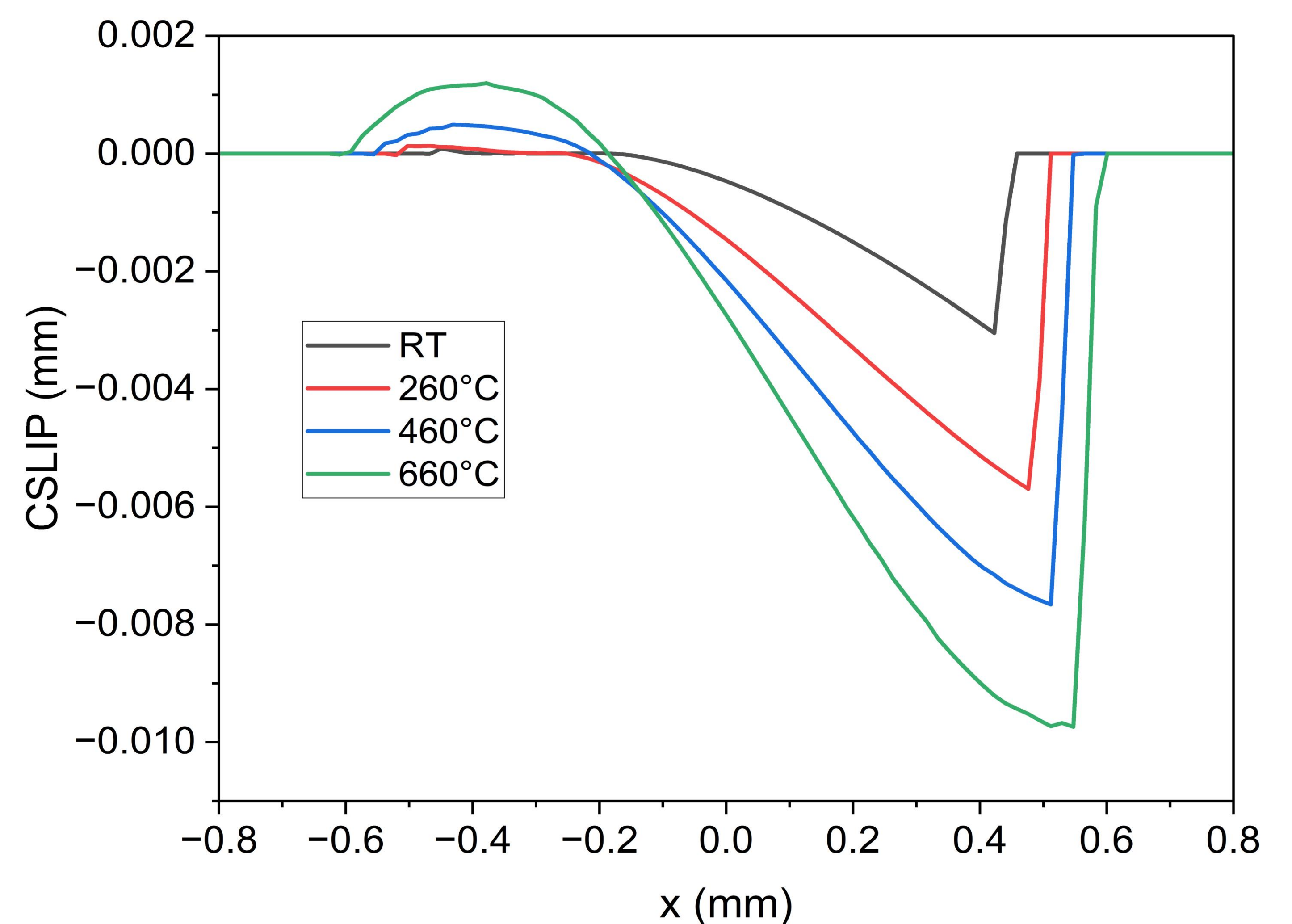
Mesh Size (contact)
4 μm



Results



Contact pressure distribution



SLIP amplitude distribution

Conclusions

- Slip amplitude increases significantly with temperature by thermal softening of Ti-6Al-4V and increased tangential compliance at elevated temperatures.
- Contact width expands with increasing temperature consistent with reduced elastic modulus and higher normal compliance predicted by Hertzian contact theory.
- Peak contact pressure decreases monotonically with temperature reflecting the degradation of material stiffness under thermal loading.
- The stick zone progressively shrinks at higher temperatures, with the stick-slip boundary shifting inward toward the contact center, indicating that elevated temperatures drive the contact condition toward a more damaging partial-slip and a near gross-slip regime.