Thermal properties and pressure-dependent elastic constants of cadmium stannate as a substrate for MEMS: An ab initio study

Abstract:

Silicon carbide (SiC) has become a suitable replacement to silicon as a substrate for manufacture of microelectromechanical systems (MEMS) that operate in harsh environmental conditions, owing to its better mechanical properties such as excellent wear resistance. However, just like silicon, SiC is also brittle, a property that limits its application as a substrate for manufacture of flexible MEMS. In this study, we explored the thermal properties as well as the pressure-dependent elastic constants of cadmium stannate (Cd_2SnO_4) for the first time within the quantum espresso code. The result showed that the elastic constants of SiC are much higher than those of Cd_2SnO_4. The properties of SiC were found to be more sensitive to the applied pressure compared those of Cd_2SnO_4, implying that it is less mechanically and thermally stable with the applied pressure compared to Cd_2SnO_4, and therefore, less appealing compared to Cd_2SnO_4 for the manufacture of most MEMS.

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