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Green body composition for layered ceramic composites

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Multilayer ceramics have the potential to replace monolithic ceramics due to their improved mechanical properties, including increased hardness, durability, and fracture toughness. The diverse loading conditions faced by structural materials require the development of customized layered structures for specific applications. A key advantage of layered ceramic composites is their ability to exhibit customized properties. Combining layers of different materials can optimize composites for specific mechanical, thermal, and electrical characteristics, enhancing performance in various environments. The use of layered composites can significantly improve the strength-to-weight ratio, which is crucial in industries such as aerospace and automotive.
Despite their advantages, layered ceramic composites face several challenges. The inherent brittleness of their components increases the risk of sudden failure under high mechanical stress, which limits their use where high fracture toughness is required. In addition, these materials are sensitive to sudden temperature changes, which can lead to thermal shock. The complexity of production is another issue. The production of layered ceramic composites involves complex processes of layer formation and sintering of raw materials, which require specialized equipment and expertise, which increases production costs and requires strict quality control.
In our study, we studied green body layering methods and advanced sintering techniques to create layered composites. Chosen method involves mixing the starting powder with a plasticizer solution, followed by reactive sintering. Various solutions were investigated. Tests have shown that some solvents can create excessive porosity, which impairs functionality. Therefore, petroleum solvent rubber was chosen because of its ability to dry at room temperature and its low level of impurities, ensuring that there is no negative impact on the sintering or compaction process. The microstructure of the resulting sample was further investigated.
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