A NOVEL ROUTE FOR THE PREPARATION OF TiB_2/TiN COMPOSITES BY SELECTIVE LASER SINTERING

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TiB_2/TiN composites are important technological materials due to the excellent high temperature oxidation and plastic deformation resistance of TiB_2, high melting points and extreme hardness of both TiN and TiB_2 phases [1]. Selective laser sintering (SLS) as one of rapid growing additive manufacturing (AM) methods is a promising technology to fabricate customize designed both geometrically and functionally complex structures [2]. However, direct sintering of TiB_2 based ceramic composites by SLS is limited by the low absorption of electron beam energy and poor thermal shock resistance. In this work, a new strategy is proposed for the synthesis of TiB_2/TiN lattice with tailored physical properties and desired architecture of the ceramic parts.

Preliminary, TiB_2/Ti powder with certain particle size and distribution was prepared using high-energy ball milling technique. By the next step, powder was subjected to SLS to obtain 3D shape of TiB_2/Ti compact. Nitridation of the consolidated samples in nitrogen atmosphere was performed aimed at obtaining of TiB_2/TiN lattice with geometriaclly defined porosity.

The influence of milling, sintering and nitridation conditions on the characteristics of both the powder and sintered parts was investigated; set of parameters has been adjusted and optimized. Phase composition and microstructure features were examined after each procedure to reveal the physicochemical transformations and morphology evolution of the composites.

References

1. Bhaumik, S. K., C. Divakar, A. Kv Singh, and G. S. Upadhyaya. "Synthesis and sintering of TiB_2 and TiB_2–TiC composite under high pressure." Materials Science and Engineering: A 279, no. 1 (2000): 275-281.
2. Bertrand, P., Bayle, F., Combe, C., Gœuriot, P., & Smurov, I. (2007). Ceramic components manufacturing by selective laser sintering. Applied Surface Science, 254(4), 989-992.

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