**Cost-affordable, high-performance Ti-TiB composite for**

**selective laser melting additive manufacturing**

**Supplementary Materials**

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**Figure SⅠ:** Electron backscatter diffraction of SLM-formed Ti-0.31B composites: (a) Image quality map of Ti, (b) Unique grain color quick map of all, (c) Image quality map of TiB, (d) Phase map of all, and (e) (f) Grain distribution of Ti and TiB.



**Figure SⅡ:** The solidification path of SLM-formed Ti-xB (x = 0.156, 0.31, 0.62) composites was predicted using Thermo-Calc software.



**Figure SⅢ:** Schematic drawing of room-temperature tensile sample.

**TABLE S****Ⅰ:** Powder flowability results for the unmodified and modified HDH-Ti powders.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sample | Angle of repose  (°) | Degree of  compression (%) | Flat  corner  (°) | Tap density (g/cm3) | Flow-  ability  index |
| unmodified | 37 | 14 | 63 | 2.38 | 68 |
| modified | 31 | 11 | 33 | 2.48 | 83 |

**TABLE SⅡ:** Comparison of the Vickers hardness, and tensile and compressive mechanical properties of Ti, Ti6Al4V, and TMCs materials processed via SLM.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Material | Vickers Hardness (Hv) | Ultimate tensile strength, σUTS(MPa) | Maximum tensile strain,  εT (%) | Ultimate compressive strength, σUCS (MPa) | Maximum compressive strain,  εmax (%) | Ref. |
| HDH-Ti | 295 | 913 | 16 | 1562 | 46 | This work |
| Ti(HDH)-0.5 wt.%TiB2 | 340 | 1007 | 8 | 1646 | 43 | This work |
| Ti(HDH)-1 wt.%TiB2 | 364 | 1100 | 1.7 | 1687 | 38 | This work |
| Ti(HDH)-2 wt.%TiB2 | 412 | -- | -- | 1813 | 33 | This work |
| CP-Ti | 261 | 757 | 19.5 | 1136 | 51 | [19] |
| Ti-5 wt.%TiB2 | 402 | -- | -- | 1421 | 17.8 | [2] |
| Ti-5 wt.%TiC | -- | 914 | 18.3 | -- | -- | [32] |
| Ti6Al4V | 409 | 1143 | 11.8 | -- | -- | [33] |
| Ti6Al4V-8 vol.%TiC | -- | 1075 | 0.3 | -- | -- | [34] |

**TABLE SⅢ:** Chemical compositions of the unmodified and modified HDH-Ti powders.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sample | Ti (wt.%) | O (wt.%) | N (wt.%) | C (wt.%) | Fe (wt.%) |
| unmodified | Bal. | 0.245 | 0.007 | 0.032 | 0.02 |
| modified | Bal. | 0.283 | 0.009 | 0.045 | 0.07 |