Supplementary Materials

Microstructural Characteristics of Plasma Sprayed NiCrBSi Amorphous Coatings and Their Wear and Corrosion Behaviors

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S1. Surface Morphology and Elemental Composition of NiCrBSi Coating

The surface morphology of NiCrBSi coating is shown in Figure S1, where the elemental composition of the smooth surface in the red rectangular zone was tested by using the energy spectrum analysis. The weight% and Atomic% results are shown in Table S1.

Figure S1. Micro surface morphology of NiCrBSi coating.

Considering that the elemental composition of the sputtered powder (C~0.8, Cr~15.5, Si~4, Fe~15, B~3.5, and Ni~61.2) is quite close to that of the measured results in Table S1, one can concluded that there is no segregation phenomenon in the uncorroded, smooth zone in Figure S1. Thus it can be concluded that the content of the amorphous phase of the uncorroded, smooth zone is relatively high.
Table S1. Elemental composition of the smooth area of NiCrBSi coating.

<table>
<thead>
<tr>
<th>Element</th>
<th>Weight%</th>
<th>Atomic%</th>
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<tbody>
<tr>
<td>C K</td>
<td>0.06</td>
<td>0.22</td>
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<tr>
<td>O K</td>
<td>2.52</td>
<td>7.58</td>
</tr>
<tr>
<td>F K</td>
<td>3.91</td>
<td>9.88</td>
</tr>
<tr>
<td>Si K</td>
<td>3.78</td>
<td>6.46</td>
</tr>
<tr>
<td>Cr K</td>
<td>17.40</td>
<td>16.09</td>
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<tr>
<td>Fe K</td>
<td>12.94</td>
<td>11.14</td>
</tr>
<tr>
<td>Ni K</td>
<td>59.39</td>
<td>48.62</td>
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<tr>
<td>Totals</td>
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S2. The Energy Spectrum Analysis of the Near-Spherical Shape Grains

As marked by the red rectangular zone, the corroded area was composed of near-spherical shape grains with grain size less than 1 μm (Figure S2). The elemental composition in the nano crystallized zone of the corroded flat particle was analyzed by using the energy spectrum analysis, where the content of Fe was relatively higher than that of the powder, while the Ni content decreased sharply and the Cr content doubled in comparison to that of the sputtered powder, as shown in Table S2. Combined with the XRD analysis, the near-spherical nanocrystallines were probably composed of Cr7C3 and Cr23C6.

![Figure S2. The SEM graph of the corroded flat particle with near-spherical shape grains.](image)

Table S2. Elemental composition of the corroded flat particle with near-spherical shape grains.

<table>
<thead>
<tr>
<th>Element</th>
<th>Weight%</th>
<th>Atomic%</th>
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<tbody>
<tr>
<td>C K</td>
<td>0.09</td>
<td>0.36</td>
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<td>O K</td>
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<td>8.73</td>
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<td>F K</td>
<td>4.69</td>
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<td>Si K</td>
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<td>4.60</td>
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<tr>
<td>Cr K</td>
<td>35.95</td>
<td>32.01</td>
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<tr>
<td>Fe K</td>
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<tr>
<td>Ni K</td>
<td>36.03</td>
<td>28.41</td>
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<td>Totals</td>
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S3. The Energy Spectrum Analysis of the “Fish Bone-Like” or “Leaf-Like” Grains

As shown in Figure S3, the corroded area was composed of “fish bone-like” or “leaf-like” grains. The elemental composition in the marked rectangular zone was analyzed by
using the energy spectrum analysis, where the content of Cr increased while the Ni content decreased slightly. As shown in Table S3, according to the atomic ratio of Ni and B, the “fish bone-like” or “leaf-like” grains were probably formed by Ni$_3$B phases majorly.

Figure S3. The SEM graph of the corroded flat particle with “fish bone-like” or “leaf-like” grains.

Table S3. Elemental composition of the corroded flat particle with “fish bone-like” or “leaf-like” grains.

<table>
<thead>
<tr>
<th>Element</th>
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<tbody>
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<td>C K</td>
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<td>F K</td>
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<td>Si K</td>
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<td>Cr K</td>
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