**Supplementary Information**

**Process–Structure–Property Relationship for Plasma-Sprayed Iron-Based Amorphous-Crystalline Composite Coatings**

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**Table S1.**  **Average temperature and velocity of the Fe based powder particle measured at several different parameters during the Accuraspray experiment**

|  |  |  |  |
| --- | --- | --- | --- |
| No. | Accuraspray parameter | Average temp. / °C | Average velocity / (m⋅s−1) |
| 1 | P1G1F1S1 | 2248 | 128.5 |
| 2 | P1G2F1S1 | 2170 | 129 |
| 3 | P1G3F1S1 | 2162 | 128 |
| 4 | P2G1F1S1 | 2281 | 141 |
| 5 | P2G2F1S1 | 2218 | 147.5 |
| 6 | P2G3F1S1 | 2219 | 141.5 |
| 7 | P3G1F1S1 | 2298 | 153 |
| 8 | P3G2F1S1 | 2271 | 164 |
| 9 | P3G3F1S1 | 2259 | 171 |
| 10 | P1G1F2S1 | 2207 | 130 |
| 11 | P1G2F2S1 | 2161 | 130 |
| 12 | P1G3F2S1 | 2150 | 132.5 |
| 13 | P2G1F2S1 | 2243 | 146 |
| 14 | P2G2F2S1 | 2219 | 148 |
| 15 | P2G3F2S1 | 2173 | 149.5 |
| 16 | P3G1F2S1 | 2327 | 159 |
| 17 | P3G2F2S1 | 2281 | 167 |
| 18 | P3G3F2S1 | 2250 | 172 |
| 19 | P1G1F1S2 | 2172 | 124 |
| 20 | P1G2F1S2 | 2158 | 112 |
| 21 | P1G3F1S2 | 2146 | 92.5 |
| 22 | P2G1F1S2 | 2219 | 136 |
| 23 | P2G2F1S2 | 2238 | 145.5 |
| 24 | P2G3F1S2 | 2196 | 142.5 |
| 25 | P3G1F1S2 | 2298 | 158 |
| 26 | P3G2F1S2 | 2253 | 164 |
| 27 | P3G3F1S2 | 2210 | 170 |
| 28 | P1G1F2S2 | 2170 | 125.5 |
| 29 | P1G2F2S2 | 2136 | 126 |
| 30 | P1G3F2S2 | 2120 | 128 |
| 31 | P2G1F2S2 | 2221 | 139 |
| 32 | P2G2F2S2 | 2190 | 147 |
| 33 | P2G3F2S2 | 2160 | 147 |
| 34 | P3G1F2S2 | 2246 | 157 |
| 35 | P3G2F2S2 | 2230 | 166.5 |
| 36 | P3G3F2S2 | 2180 | 168 |

**Section S1. Test of the powder flowability**

Flowability of the powder was characterized by keeping the theoretical feed rate 4 g/min. carrier gas pressure 414 kPa and carrier gas flow as 0.28 m3/h and vibrator air pressure as 138 kPa using the Metco powder feeder. Three reading were recorded for the feed rate and tabulated in Table S2. All the three readings are very consistent and the average flowability of the power was found to be 98.6 %.

**Table S2.** **Flowability of the Alloy-1 powder by keeping the theoretical feed rate as 4 g/min, carrier gas pressure 414 kPa and carrier gas flow as 0.28 m3/h and vibrator air pressure as 138 kPa**

|  |  |  |
| --- | --- | --- |
| S. No. | Exp. feed rate (g/min) | Flowability/ % |
| 1 | 3.96  | 99  |
| 2 | 3.98  | 99.5  |
| 3 | 3.90  | 97.5  |
| Avg. | 3.94  | 98.6  |

**Fig. S1**



**Fig. S1:** **DSC isotherm of the Fe based powder**

**Fig. S2**



**Fig. S2.** **Digital image of the coatings fabricated using (a) P3 = 35 kW showing melted coatings and (b) P2G3F1S1 also showing sign of melting.**

**Fig. S3:**



**Fig. S3. DSC isotherm for the Fe based coatings synthesized at parameters set (a) P1G3F2S2; (b) P1G2F1S1; (c) P2G1F2S1; (d) P1G3F1S2 and (e) P1G2F2S1.**

**Table S3. DSC of Fe based alloys free standing coatings depicting the enthalpy of crystallization (Δ*H*) of all the five coatings.**

|  |  |  |
| --- | --- | --- |
| S. No. | Sample codes | Δ*H* (kJ/g)from DSC |
| 1 | P1G2F1S1 | 10.52 |
| 2 | P1G2F2S1 | 11.00 |
| 3 | P1G3F1S2 | 12.12 |
| 4 | P1G3F2S2 | 8.60 |
| 5 | P2G1F2S1 | 8.81 |