Appendix I

Regression equations for electrode coating properties.

Enthalpy (ΔH) = - 9521.9998 CaO – 1.49621 x 10^5 CaF_2 – 1.56028 TiO_2 – 2.04702 SiO_2 + 5898.45582 CaO.CaF_2 + 5881.32119 CaO.TiO_2 + 0.22212 CaO. SiO_2 + 8551.42489 CaF_2.TiO_2 + 10177.64001 CaF_2.SiO_2 – 227.63392 CaO.CaF_2.TiO_2 – 206.72584 CaF_2.TiO_2.SiO_2 + 39.08316 CaO.SiO_2 (CaO – SiO_2) – 118.79306 CaF_2.SIO_2 (CaF_2 – SiO_2) (A1)

Weight Loss (ΔW) = - 16.65314 CaO – 15.27025 CaF_2 – 19.551 TiO_2 + 121.76639 SiO_2 + 1.0474_2 CaO.CaF_2 + 1.08929 CaO.TiO_2 – 2.11269 CaO.SiO_2 + 1.21176 CaF_2.TiO_2 – 3.8628 CaF_2.SiO_2 – 2.54676 TiO2.SiO_2 – 0.053509 CaO.CaF_2.TiO_2 + 0.056358 CaO.CaF_2.SiO_2 + 0.027196 CaO.TiO_2.SiO_2 + 0.067243 CaF_2.TiO_2.SiO_2 (A2)

Density (ρ) = - 0.45323 CaO – 0.30242 CaF_2 - 7.90995 x 10-3 TiO_2 + 0.011693 SiO_2 + 0.023061 CaO.CaF_2 + 0.012321 CaO.TiO_2 + 0.030548 CaO.SiO_2 + 3.66047 x 10^{-3} CaF_2.TiO_2 + 6.26017 x 10^{-3} CaF_2.SiO_2 – 0.026395 TiO_2.SiO_2 – 4.28377 x 10^{-4} CaO.CaF_2.TiO_2 – 1.2139 x 10^{-3} CaO.CaF_2.SiO_2 – 7.84805 x 10^{-5} CaO.TiO_2.SiO_2 + 1.16853 x 10^{-3} CaF_2.TiO_2.SiO_2 (A3)

Conductivity (C) = 0.24251 CaO + 0.91207 CaF_2 + 0.80424 TiO_2 – 1.39687 SiO_2 – 0.027655 CaO.CaF_2 – 0.025563 CaO.TiO_2 + 0.049441 CaO.SiO_2 – 0.051677 CaF_2.TiO_2 + 0.019250 CaF_2.SiO_2 + 4.59608 x 10^{-3} TiO_2.SiO_2 + 1.3182 x 10^{-3} CaO.CaF_2.TiO_2 – 1.1868 x 10^{-3} CaO.CaF_2.SiO_2 – 6.52596 x 10^{-4} CaO.TiO_2.SiO_2 + 7.34283 x 10^{-4} CaF_2.TiO_2.SiO_2 (A4)

Diffusivity (D) = - 0.075722 CaO + 0.58821 CaF_2 + 0.29142 TiO_2 – 2.88523 SiO_2 – 0.015329 CaO.CaF_2 – 7.20227 x 10^{-3} CaO.TiO_2 + 0.089024 CaO.SiO_2 – 0.033612 CaF_2.TiO_2 + 0.042418 CaF_2.SiO_2 + 0.057494 TiO_2.SiO_2 + 9.76046 x 10^{-4} CaO.CaF_2.TiO_2 – 1.4204 x 10^{-3} CaO.CaF_2.SiO_2 +1.77628 x 10^{-3} CaO.TiO_2.SiO_2 + 2.03225 x 10^{-4} CaF_2.TiO_2.SiO_2 (A5)

Specific Heat (S) = 1.15957 CaO + 1.45556 CaF_2 + 1.69540 TiO_2 + 5.04638 SiO_2 – 0.052764 CaO.CaF_2 – 0.061713 CaO.TiO_2 – 0.13434 CaO.SiO_2 – 0.068162 CaF_2.TiO_2 – 0.099968 CaF_2.SiO_2 – 0.16404 TiO_2.SiO_2 + 1.34202 x 10-3 CaO.CaF_2.TiO_2 + 1.37168 x 10-3 CaO.CaF_2.SiO_2 + 3.32928 x 10^{-3} CaO.TiO_2.SiO_2 + 1.84925 x 10^{-5} CaF_2.TiO_2.SiO_2 (A6)

Contact Angle (θ): - 2.80525 CaO + 32.7706 CaF_2 + 8.50672 TiO_2 + 79.97459 SiO_2 – 0.47219 CaO.CaF_2 + 0.26386 CaO.TiO_2 + 0.88374 CaO.SiO_2 – 0.94544 CaF_2.TiO_2 – 1.02778 CaF_2.SiO_2 – 1.69629 TiO_2.SiO_2 (A7)

Surface Tension (Υ): 6.94345 CaO + 3.19079 CaF_2 + 4.92612 TiO_2 + 2.31423 SiO_2 + 0.022059 CaO.CaF_2 +8.987 x 10^{-3} CaO.TiO_2 + 0.018488 CaO.SiO_2 – 1.64642 x 10^{-3} CaF_2.TiO_2 + 0.012599 CaF_2.SiO_2 + 5.00587x10^{-3} TiO_2.SiO_2 (A8)

Adhesion Energy (E): -0.19505 CaO – 2.58255 CaF_2 – 1.00651 TiO_2 + 6.83859 SiO_2 + 0.076739 CaO.CaF_2 + 0.030243 CaO.TiO_2 – 0.21749 CaO.SiO_2 + 0.11924 CaF_2.TiO_2 – 0.078130 CaF_2.SiO_2 – 0.16784 TiO_2.SiO_2 – 3.31264 x 10^{-3} CaO.CaF_2.TiO_2 + 2.80356 x 10^{-3} CaO.CaF_2.SiO_2 + 5.56461 x 10^{-3} CaO.TiO_2.SiO_2 – 1.19079 x 10^{-4} CaF_2.TiO_2.SiO_2 (A9)

Spread Area (A): - 84472.00847 CaO – 2.02356 x 10^5 CaF_2 – 1.21698 x 10^5 TiO_2 + 42847.344 SiO_2 + 6919.96026 CaO.CaF_2 + 4726.59687 CaO.TiO_2 – 797.62891 CaO.SiO_2 + 8548.13105 CaF_2.TiO_2 + 4107.62192 CaF_2.SiO_2 – 639.92675 TiO_2.SiO_2 – 219.309 CaO.CaF_2.TiO_2 – 58.57996 CaO.CaF_2.SiO_2 + 68.17981 CaO.TiO_2.SiO_2 + 72.15007 CaF_2.TiO_2.SiO_2 (A10)

Regression equations for multi pass bead on plate properties and chemistry.

Carbon = 0.048790 CaO + 0.031345 CaF_2 + 0.046573 TiO_2 – 0.081129 SiO_2 + 2.15253 x 10^{-3} Cao.CaF_2 - 2.50381 x 10^{-3} CaO.TiO_2 – 1.37341 x 10^{-4} CaO.SiO_2 - 2.0357 x 10^{-3} CaF_2.TiO_2 + 4.32129 x 10^{-3} CaF_2.SiO_2 + 8.31993 x 10^{-4} TiO_2.SiO_2 + 8.30835 x 10^{-5} CaO.CaF_2.TiO_2 – 4.92397 x 10^{-5} CaO.CaF_2.SiO_2 + 4.25254 x 10^{-5} CaO.TiO_2.SiO_2 – 9.00782 x 10^{-5} CaF_2.TiO_2.SiO_2 (A11)

Silicon = - 0.081193 CaO – 0.40238 CaF_2 + 0.11487 TiO_2 + 0.41202 SiO_2 + 0.013077 Cao.CaF_2 - 1.75488 x 10^{-3} Cao.TiO_2 – 6.2524 x 10^{-3} CaO.SiO_2 + 6.07966 x 10^{-3} CaF_2.TiO_2 + 0.022316 CaF_2.SiO_2 - 0.027703 TiO_2.SiO_2 – 1.66096 x 10^{-4} CaO.CaF_2.SiO_2 + 7.04938 x 10^{-4} CaO.TiO_2.SiO_2 + 1.2345 x 10^{-5} CaF_2.TiO_2.SiO_2 (A12)

Manganese = - 0.23010 CaO – 1.89948 CaF_2 – 2.03505 TiO_2 + 3.56636 SiO_2 + 0.044581 Cao.CaF_2 + 0.054137 Cao.TiO_2 – 0.14789 Cao.SiO_2 + 0.12332 CaF_2.TiO_2 – 0.070059 CaF_2.SiO_2 + 0.026261 TiO_2.SiO_2 – 2.70301 x 10^{-3} CaO.CaF_2.TiO_2 – 4.6246 x 10^{-3} CaO.CaF_2.SiO_2 + 1.27013 x 10^{-3} CaO.TiO_2.SiO_2 – 3.08232 x 10^{-3} CaF_2.TiO_2.SiO_2 (A13)

Chromium = 3.34875 CaO – 16.74579 CaF_2 – 19.67206 TiO_2 + 60.03133 SiO_2 + 0.29309 CaO. CaF_2 + 0.41741 CaO.TiO_2 – 2.44522 CaO.SiO_2 + 1.29316 CaF_2.TiO_2 – 1.10464 CaF_2.SiO_2 – 0.1829 TiO_2.SiO_2 – 0.028677 CaO.CaF_2.TiO_2 + 0.062915 CaO.CaF_2.SiO_2 + 0.031517 CaO.TiO_2.SiO_2 – 0.036530 CaF_2.TiO_2.SiO_2 (A14)

Ni = 0.10662 CaO + 0.1096 CaF_2 + 0.15104 TiO_2 + 0.12951 SiO_2 (A15)

Phosphorus = 4.776x10^{-2} CaO + 5.0404x10^{-2} CaF_2 + 6.7292x10^{-2} TiO_2 + 2.0132x10^{-2} SiO_2 – 2.25865x10^{-3} CaO.CaF_2 – 2.8062x10^{-3} CaO.TiO_2 – 1.68777x10^{-3} CaO.SiO_2 – 2.93818x10^{-3} CaF_2.TiO_2 + 1.19007x10^{-3} CaF_2 SiO_2 – 3.0113x10^{-3} TiO_2.SiO_2 + 8.35508x10^{-5} CaO.CaF_2.TiO_2 – 3.31891x10^{-5} CaO.CaF_2. SiO_2 + 9.36057x10^{-5} CaO.TiO_2.SiO_2 + 55.533x10^{-6} CaF_2. TiO_2.SiO_2 (A16)

Sulphur = -2.2728x10^{-2} CaO + 3.9221x10^{-2} CaF_2 – 2.9862x10^{-2} TiO_2 – 11.152x10^{-2} SiO_2 – 1.62756x10^{-3} CaO.CaF_2 – 1.33216x10^{-3} CaO.SiO_2 + 2.0344x10^{-3} CaO. SiO_2 – 1.94009x10^{-3} CaF_2. TiO_2 + 1.8939x10^{-3} CaF_2.TiO_2 + 2.62018x10^{-3} TiO_2.SiO_2 + 6.18178x10^{-5} CaO.CaF_2.TiO_2 – 2.17948x10^{-5} CaO.CaF_2.TiO_2 – 4.68718x10^{-5} CaO.TiO_2.SiO_2 – 3.71471x10^{-5} CaF_2.TiO_2.SiO_2 (A17)

Molybdenum = 5.9822x10^{-2} CaO – 31.528x10^{-2} CaF_2 – 22.917x10^{-2} TiO_2 + 79.772 x 10^{-2} SiO_2 + 5.5944x10^{-3} CaO.CaF_2 + 3.83804x10^{-3} CaO.TiO_2 - 34.929x10^{-3} CaO.SiO_2 + 18.635x10^{-3} CaF_2.TiO_2 – 7.59546x10^{-3} TiO_2.SiO_2 – 6.17789x10^{-3} TiO_2.SiO_2 + 7.30371x10^{-4} CaO.CaF_2.SiO_2 + 6.098x10^{-4} CaO.TiO_2.SiO_2 - 3.86329x10^{-4} CaO.CaF_2. TiO_2 - 5.89011x10^{-4} CaF_2.TiO_2.SiO_2 (A18)

Microhardness = - 14.28461 CaO + 1.34428 CaF_2 – 9.86833 TiO_2 + 115.52904 SiO_2 + 0.49961 CaO. CaF_2 - 0.68365 CaO.TiO_2 – 0.80883 CaO.SiO_2 + 0.38182 CaF_2.TiO_2 + 2.02614 CaF_2.SiO_2 + 2.46587 TiO_2.SiO_2 (A19)

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- Waris Nawaz Khan, Rahul Chhibber. (2020), Effect of intermetallic/secondary phases on wear behavior of super duplex stainless steel in dry and wet medium. Tribology Transactions. 63(3):403-414.
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