Chapter 5

Conclusions

1. Characterization of the as received pump plunger and wear performance

The as received pump plunger composed of two part; the bulk inner (core) part and the outer layer which was identified as spray and fuse coating. The core part had Fe and Cr as principal component. The outer coating contained Ni Cr and Si as major elements. The coating layer had the hardness. The abrasive wear rate of the as received plunger was found to be 0.045 g/m.

2. Characterization of sprayed materials and coatings

In-flight particle

- Size of in-flight particle strongly related to the content of metallic phase to the whole cored wire (outer metallic shell and filler); mainly depended on size of filler particles as expected.

- WC-Cr-Ni cored wire produced the smallest in-flight particle size, disc-shape splat with the highest degree of flatting.

Splat

- WC-Cr-Fe cored wire, although had a comparable splat size with that of WC-Cr-Ni cored wire, a larger in-flight particle size and more splashing were observed. This corresponded to a higher metal content in WC-Cr-Fe cored wire.

Coatings

WC-Cr-Ni coatings containing high carbide content resulted in high hardness, however, less dense microstructure. The W-Cr-Fe nanocomposite cored wire contained more content of metallic phase compared to other resulted larger in-flight particle size and higher splashing degree. W-Cr-Fe nanocomposite cored wire, not only had nanostructured filler but also had multiphase structure. W-Cr-Fe nanocomposite coating exhibited dense structure superior properties.

3. Wear performance of coatings

Sliding wear

- Sliding wear rate of WC-Cr-Ni coating was lower than other coating, as a result of high WC content. WC-Cr-Fe coating showed highest wear rate, corresponded to its low hardness and high porosity.

4. Test of plunger coating under simulated condition

- The efficiency of the plunger after 100000 m test distance under simulated conditions showed insignificant degree of plunger diameter. Plunger coated with W-Cr-Fe nanocomposite material show smoother worn surface than other coating implying higher wear resistance.