6.0 Conclusions

Phenolic resin can be successfully used as a binder in the making of diamond preforms. Increasing the binder content from 5wt% to 10wt% improves the infiltration depths of both the SiC-coated and uncoated diamond. Increasing the resin content, above 10wt%, results in lower porosity of the preforms, this leads to the reaction choking of the pores during SiC product formation. Hence there exists an optimum amount of resin that can improve infiltration \cite{27}.

Diamond can be successfully coated with SiC and TiC since Si and Ti are well known to be good carbide forming materials. The coating of diamond with SiC was successful at 1300\(^\circ\)C and with TiC at 750\(^\circ\)C. The microstructures of the coatings were uniform at these coating temperatures.

A maximum infiltration depth (from the base) of 3.31mm was achieved at 10MPa compaction pressure for uncoated diamond and 3.71mm was achieved at 10MPa compaction pressure for SiC-coated diamond. Both these maximum infiltration depths were achieved at 10wt% resin content. Coating of diamond with SiC helped improve infiltration (Fig. 5.4). This was because the SiC coating layer prevented the fast reaction between silicon and carbon thus curbing the reaction choking effect. Also the increase in porosity (decrease in compaction pressure) of the preforms helped increase the infiltration depths of both the uncoated and SiC-coated diamond.
The resulting composite material exhibits good wear behaviour comparable to that of Syndax at both lower and higher cutting speeds i.e. 100m/min and 400m/min respectively. The produced composites, from both uncoated and SiC-coated diamond, have a high hardness value but the true values could not be measured since the indenters were breaking at a load of 35kg.

6.1 Recommendations

1. A different binder can be investigated to explore the possibilities of improving infiltration depths since the infiltration depth is also dependent on the infiltrant properties.

2. Infiltration should be tried in vacuum since trial runs with SiC coated diamond in vacuum yielded higher infiltration depth when compared to the runs done in an argon environment at the same compaction pressure for both coated and SiC coated diamond.

3. The coating thickness on the diamond particles can be increased to >1µm, to see if the infiltration depth will also increase.

4. Infiltration of diamond coated with TiC should be investigated to see if it could also help in preventing the fast reaction between diamond and silicon. This study could not be done in this work due to time constraints.