E1-02: Fabrication of corundum/silicon-carbide abrasive grinding wheels

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Ceramic-bonded abrasive grains such as corundum, silicon carbide etc., exhibit the most satisfactory all-purpose grinding properties such as high strength, high modulus of elasticity and good refractoriness.

Relatively high percentage of corundum/silicon carbide, of particle size about 100 microns were bonded in a clay based matrix and a small amount of different sintering additives such as manganese dioxide (MnO_2) were introduced in a suitable ratio to obtain moderately low firing temperature and better bonding. Powder pressing technique was used to prepare the samples. The compact sample was sintered at 1,200 °C for several hours.

To obtain the basic parameters related to grinding properties of the material, suitable tests were carried out. Rectangular bar samples of size 3 mm x 6 mm x 20 mm were prepared and the fracture toughness (K_{IC}) and the Bend strength (c) of the material measured. Fracture toughness was about 2.3 MPa $m^{1/2}$, which is better than that of porcelain ceramics (K_{Ic}=0.9 MPam$^{1/2}$). The bend strength of the material was comparable to that of porcelain ceramics and had a value about 37.5 MPa. The density, apparent porosity and firing shrinkage were about 1.9×10^3 kg m^{-3}, 7% and 1% respectively. The relative hardness lies well above glass and hard steel.

This preliminary study shows that the MnO_2 added corundum/silicon carbide compositions have promising grinding properties.