Chapter 10

Summary and Conclusions

Sucrose has been proved to be an alternative binder suitable for dry processing of ceramic powder. Porous alumina ceramics with wide range of porosity (20-66 vol%) and pore size (50-516 μm) having either isolated and/or interconnected pores were successfully fabricated via dry pressing and sintering, using rice husk as pore former and sucrose as binder as well as a pore former. This has been achieved through microstructural tailoring of porous alumina compacts, by varying rice husk content and its particle size in the composition. Rice husk in combination with sucrose in the selected composition range along with optimized processing conditions resulted in successful fabrication of defect free porous alumina ceramics with tailored microstructure and properties.

Various properties such as electrical, mechanical, thermal and permeability characteristics of the developed porous alumina were studied and co-related with their microstructure. Summary of different characterization studies have been given at the end of respective chapters. A short summary is presented here. The flexural strength, compressive strength, elastic modulus, and hardness value of the obtained porous alumina ceramics were in the range 207.6-22.3 MPa, 180-9.18 MPa, 250-18 GPa and 149-18 HRD, respectively. The thermal conductivity of the developed samples was in the range 1.2-24 W/mK. Room temperature dielectric constant (ε′) was in the range 3.6-6.3 and corresponding loss tangent (tan δ) in the range 0.4 $x10^{-3}$-0.03 $x10^{-3}$ at 1 Hz. The Darcian permeability (k_1) of porous alumina was found to be in the range of $0.38x10^{-10}$ m^2 to $9.15x10^{-10}$ m^2 which is in the order of magnitude of gas filters. The non Darcian permeability (k_2) ranges from 0.33 $x10^{-5}$ to $3.92x10^{-5}$ m.

The unique combination of rice husk and sucrose as major additives in the present process is a novel approach towards successful fabrication of RH based porous alumina with tailored microstructure and properties. The process is simple and has been established in terms of standardized process steps. Considering the benefit of use of low cost additives such as rice husk and sucrose, in addition to the

cost effective end products with wide range of microstructure and diversified properties, the application area can be chosen depending on the requirement. The developed porous ceramics can be chosen to be used in various applications such as thermal, electrical and electronic, structural, permeability applications etc.

The present study opens up an opportunity for utilization of rice husk, an agricultural waste material, for fabrication of porous ceramics having wide range of microstructure and properties using other ceramic materials suitable for technical and engineering applications.