UNIVERSITI TEKNOLOGI MARA

PREPARATION OF CERAMIC SUPPORT FROM WASTE: EFFECT OF SINTERING TEMPERATURE

NASHRAH AYNA BINTI SHAH FIESAL

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ABSTRACT

A structure of ceramic support has been fabricated from broken ceramic waste. Ceramic waste of former was used as raw material which is obtained from a glove manufacturing company. The ceramic wastes which contain high source of alumina and silica were initially crushed into powders. The powders were mixed with binders and formed into cylindrical pellets. The preparation of the support was carried out based on press molding or compaction technique at a pressure of 160MPa. In this study, the effects of sintering temperatures were investigated by evaluating the phase characterization, porosity properties of the supports, average pore size and microstructure of the sintered samples. Sintering temperatures were carried out in a range of 900 to 1200℃ with an interval of 100℃ for 2.5 hours. The evaluation was carried out through the use of X-ray diffraction (XRD) and scanning electron microscopy (SEM). Based on the analysis, major crystalline phase of the sintered samples was mullite. However, fewer peaks were detected at 1200℃ resulting to a decrease in the mullite crystal phase. Results from sintering showed that, with increasing of temperature, open porosity showed a decrease trend in the sintered samples from 45.32% to 14.67% at 1200℃. Also, with increasing sintering temperature, average pore size increases with a maximum average of 17.04 μm at the final sintering temperature of 1200℃. On the other hand, SEM observation on microstructure of the sintered samples showed higher densification at 1200 ℃ compared to the other temperatures.

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INTRODUCTION

1.1 RESEARCH BACKGROUND

Nowadays, with current strong environmental demands, porous ceramic membranes have seen to be the leading applications for industrial separation processes such as filtration and separation. Membrane filtration is turning the choice in innovation on liquid separations around the world for applicants from desalination to the removal of suspended solids from water. Mostly, the production of membrane today has a short lifecycles of 5 to 10 years compared to 20 years of ceramic membranes which relates to the polymeric boundary layer (Ceramic Membrane, 2014).

Porous ceramic membranes are as well as reasonable for applications where the utilization of polymeric membrane is impractical or not economical. Besides their excellent productive life, ceramic membranes itself offers various advantages over other materials such as high chemical, thermal and mechanical resistance, hardness, corrosion and low density. These qualities are among the essential properties which have been attracting much attention in established researches as of late. (Hammel et. al. 2014).

On the other hand, a great trend of these advanced porous ceramics shows its importance as the demand gets higher in the ceramic industry. A ceramic membrane contains three layers of structure known as the top membrane layer, the intermediate layer and the support. The support gives a mechanical strength to the top most membrane layer and it is also responsible to provide an integrated structural for the membrane (Konegger et. al, 2016). Most supports are made of inorganic materials such as alumina, titania and zirconia. However, the fabrication of the ceramic supports tends to have costs issues because of the expensive raw materials.

Recently, the interest has grown especially on utilizing the recycled waste material from various sort of industrial branches on preparing these ceramic membrane supports (Doynov et al., 2016). A wide range of materials are said to be the