E1-03: Extraction of zirconia from zircon sand

B S B Karunaratne, P Ekanayake, T M T N Tennakoon
(Dept of Physics, Univ of Peradeniya)

Zirconia (ZrO_2) is an important material for the production of technologically useful devices such as oxygen sensors and solid oxide fuel cells. Zircon ($ZrSiO_4$), the silicate of zirconium is the major source of zirconia. There is a vast amount of zircon sand available in coastal areas of Sri Lanka.

This study was concerned with the extraction techniques of zirconia from zircon. Zircon sand was ball-milled in water media and then calcinated at 700°C. Dried powder (<64 μm) was fused with a mixture of sodium hydroxide and sodium fluoride. Fused mass was dissolved in distilled water and precipitated as zirconium hydroxide by adding ammonia. This was then converted into zirconia by direct heating and also through the oxychloride route. To obtain zirconium oxychloride, the zirconium hydroxide was dissolved in concentrated hydrochloric acid and dried. Zirconium oxychloride was boiled with ammonium hydroxide and hydrogen peroxide for about 8 h and then dried to obtain zirconia.

In each step of the process, the products were identified by XRD (X-ray diffraction analysis). The effect of fusion temperature and duration, on the degree of conversion of zircon to zirconia were studied by XRD analysis to obtain the optimum conditions.

XRD analysis showed that a complete conversion resulted with both methods. The direct heating of zirconium hydroxide led to the formation of both cubic and monoclinic phases of zirconia, whereas zirconium oxychloride route led to the formation of mainly the monoclinic phase. The observations also revealed that the fusion temperature around 1,000 °C for about 20 minutes can give rise to a maximum yield.

Financial assistance by NARESA and Univ of Peradeniya Research Grants are acknowledged.