

3 - 30 Reduction of Thorium Dioxide by Calcium

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Thorium can be utilised as the target material for the production of medical isotopes like ^{225}Ac , ^{223}Ra , ^{99}Mo and others. Metal thorium can be obtained by reduction of thorium dioxide or thorium tetrafluoride using more active metals such as calcium, magnesium, and sodium^[1–3]. This research focuses on the process of producing metal thorium using calcium to reduce the thorium dioxide powder. This method may prepare the metal thorium required by the laboratory easily and conveniently.

The flow chart is shown in Fig. 1. Firstly, thorium dioxide powder, metal calcium powder, calcium chloride and metal thorium are uniformly mixed. The amount of metal calcium addition is 1.5 times the stoichiometric ratio required for the chemical reaction to ensure the reduction of thorium dioxide completely. Calcium chloride is used as a cosolvent to improve reaction rate and reduction efficiency. The addition of little metal thorium improves the nucleation rate of thorium metal grains and increases the size of thorium grains. The reduction reaction is carried out at 950 °C in a vacuum furnace. After reduction, most of the calcium and calcium chloride can be removed by soaking in water for a long time, then washing the residue with acid, distilled water and ethanol sequentially. Finally, the metal thorium powder can be obtained by drying the above product. The XRD spectra of the metal thorium powder are shown in Fig. 1.

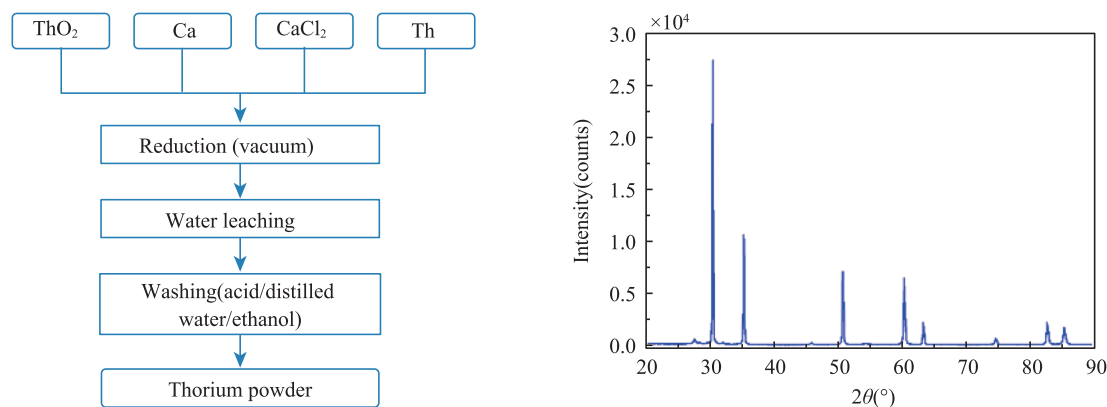


Fig. 1 (color online) The left is the flow chart of the reduction of thorium dioxide. The right is the XRD spectra of the metal thorium.

References

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