CHAPTER 1

INTRODUCTION

After the discovery of zirconium, it was realized that zirconium had particulary attractive nuclear properties. Unlike the more common engineering materials, the metal absorbs very few thermal neutrons, i.e. it has a very low absorption cross section. Thus enables it to be used extensively in the core of reactors without absorbing too many neutrons and thus stopping the chain reaction. The only other metals with this property are magnesium and aluminium - both of which have low melting points - and beryllium which is brittle, difficult to fabricate and very expensive. Zirconium thus became a very important material in the nuclear industry, particularly in respect of its use as cladding material of fuel elements in water-cooled reactors.[1]

Zirconium, formerly considered as a rare element is fairly abundant in the earth crust. It is more abundant than nickel, copper, lead and zinc. Zircon is the commercial mineral source of zirconium metal and its compounds.

Zircon, the most widely distributed and most abundant zirconium bearing mineral, is an orthosilicate with the formula $ZrSiO_4$ (theoretically 67.2% ZrO_2 and 32.8% SiO_2). Hafnium occurs almost invariably associated with zirconium minerals and the hafnium oxide content of zircon varies between 0.5-2.0 per cent.

Hafnium has a high neutron absorption cross section of 115 barns. The normal hafnium content in average quality zirconium would therefore cause an increase in the cross section of such zirconium from 0.18 barn to well over 1 barn. A hafnium removal step is therefore necessary in the production of reacter grade zirconium Impurities detrimental to the corrosion resistance or to the structural and fabricating properties of reactor grade zirconium must be low. Many common elements have cross sections of less than 5 barns, and 0.1 per cent of such elements can certainly be tolerated as impurities.[2]

The sand used in the present study was obtained from Sahasinrarethai Company. The deposits occur in the southern part of Thailand.

Realizing the strategic importance of this mineral, the Office of Atomic Energy for Peace (OAEP) is now carrying out a detailed investigation on the extraction and seperation of zirconium from this ore. The present work which is the first part of the investigation, covers the labaratory studies of zirconium seperation from the ore by alkali fusion and followed by the purification of zirconium by solvent extraction.