

Thorium reserves – potential for power generation, exploration and mining

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Beach sand minerals (BSM) are a suite of seven minerals viz. ilmenite, rutile, leucoxene, zircon, sillimanite, garnet and monazite. These minerals are also known as Heavy Minerals (HM), as their densities range between 3.2 to 5.2 g/cc which are higher than that of silica or quartz constituting the bulk of gangue materials in the beach sand. The first three of these minerals are titanium bearing, while the next three are silicates of zirconium (zircon), aluminium (sillimanite) and iron aluminate (garnet). Monazite is a phosphate of rare earths, thorium (8-9%) uranium (0.35%) which renders the mineral radio-active.

The BSM are separated from each other to their mineralogical purer forms by taking advantages of their differences in size, density, electrical and magnetic properties. Thorium is separated from monazite by caustic attack followed by various steps of solvent extraction.

The estimated resources as on 31-03-2015 of natural uranium in India is about 1,86,000 tons compared to more than 9,60,000 tons of thorium oxide deposit. India has the world's largest deposits of thorium. The three stage Atomic Energy Program adopted by India for harnessing the nuclear energy is based on utilization of the scarcely available uranium in the country along with abundant availability of thorium, so that plutonium generated from utilization of natural uranium in power reactors using heavy water as moderator can be successfully used to breed fissile materials from thorium in most efficient manner in breeder reactors which are also capable to producing energy. Utilization of vast resources of available thorium by the breeder route will be a potential source of nuclear power for sustaining the growing energy requirement of India in long term. Thanks to the problems of greenhouse gas emissions and the depleting limited hydro-carbon resources of the country, nuclear power is likely to play a significant role in the energy production sector.

The subject matter of the talk focuses on prospects and challenges in developing the process technologies of various value added products from monazite and myriad of applications in the above mentioned industry sectors which are ever evolving with time.

Dr. R. N. Patra

Dr. R. N. Patra, Chairman & Managing Director of Indian Rare Earths Limited (IREL), a Govt. of India Undertaking under the Department of Atomic Energy (DAE), has wide range of experience spanning research and development of desalination systems, designing and commissioning of plants under the Technology Commissions Programme of the Govt. of India for supply of drinking water to villages, operation of metallurgical process plants and marketing of industrial minerals. Dr. R.N. Patra, a graduate in Chemical Engineering with Honours from IIT, Kharagpur started his career in the Bhabha Atomic Research Centre at Trombay, Mumbai (BARC). Subsequently he has obtained his Ph.D in Chemical Engineering (Reverse Osmosis/hyper filtration) from IIT, Mumbai.



Dr. Patra joined Indian Rare Earths Ltd. In 1989 on deputation from BARC and worked as Plant Manager of its chemical plant at its Orissa Sands Complex (OSCOM) Project at Odisha. He also held the position of Factory Manager of its Thorium Plant at Trombay. Dr. Patra was holding the position of Chief General Manager (Marketing) in the Corporate Office at Mumbai before taking up the assignment as Director (Technical) in 2006. Dr. Patra took over as the Chairman & Managing Director of the Company in 2009.