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V

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V

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PROCEEDINGS

JAHORINA
15th - 17th March 2017

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CRITICAL MATERIALS AND CIRCULAR ECONOMY

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Abstract

Scientific results and their application in technological and technical solutions, especially in the IT, telecommunications and energy sectors and transportation as well as in the remaining three areas-food, health and environment that define the framework of civilization permanently develop and use new substances that with their characteristics exceed the previous generations, primarily due to exceptional characteristics of some rare and scattered elements that improve performances of devices and assemblies in which they are installed. Quantities required per product unit in relation to the gross mass fall within the wide spectrum-from ppm to percentages.

Available quantities and reserves of these elements in the form of mineral raw materials and some abiotic and biotic compounds and mixtures as natural resources are limited and geographically unevenly distributed, while the demands are almost having exponential growth. In the scientific, technological and economics terminology, all these are "critical materials" [1]. The best example of critical materials are elements that make magnets of high-tech products, starting from those that have the weight of a few grams and less in computers and mobile phones, to those whose mass is expressed in kilograms, that may be found in electrical and hybrid vehicles and wind generators where the magnet weight amounts to 1-2 t. Their exploitation period ranges from 2-3 to 20-30 years. These magnets are most often magnets of the neodymium-iron-boron type, that make more than 30% of the gross mass, and that also contain other lanthanide elements as microcomponents, such as praseodymium, terbium and dysprosium. These elements, together with yttrium and sometimes with scandium are classified as rare earth elements (REE) and there are 16 of them in total (Y and Sc + 14 lanthanides).

The other large group of generally used products are engine catalytic converters with internal combustion where the platinum-group elements (PGEs)-ruthenium, rhodium, palladium, osmium, iridium and platinum are predominantly used as critical elements, including also rare earth elements

such as lanthanum, cerium, praseodymium and niobium [2,3].

The manufacture and use of goods that after the expiry of the term during which they may be used, known as the EOL (End-of-Life), end up without any value, i.e. as waste is linear economy which vanishes or that will vanish soon and be replaced by circular economy which is the key of the sustainable development that implies maximum recycling, reduction of the used material per product unit and reuse for the same or for other, redesigned purpose, which is defined by the three essential principles. The situation with critical materials does not leave the room for any other choice except for becoming involved in the circular economy trends, so it is deemed that in the next 10-15 years recycling will be a dominant source of these strategic substances [4-8].
The lecture include, besides the current issues, problems and dilemmas about critical materials and circular economy,connections among them and a review of some contemporary technologies that are used to recycle rare earth elementsfrom electronic and electrical products, i.e. waste from these categories. Such procedures dominantlyfall within the scope of hydrometallurgy and potentially biogeotechnology on the base with in principles (12+12) of green chemistry and green engineering , and in the results in this area of the author research group presented [7, 9-14].
Finally, included in and selected examples of the possibility of obtaining some critical material, such as for example gallium, in our surrounding [15].

***Keywords**: critical materials, REE, circular economy, recycling.*

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