E David et al., Int J Waste Resour 2017, 7:3(Suppl)
DOI: 10.4172/2252-5211-C1-005

Recycling approaches of the aluminum dross to obtain useful products and to preserve raw material sources

E David[1] and **J Kopac**[2]
[1]National Institute for Cryogenic and Isotopic Technologies, Romania
[2]University of Ljubljana, Slovenia

The aim of this research is to answer the challenge of how a hazardous waste can be transformed into raw material source, presenting the particular case of a solid aluminum residue, such as aluminum dross. In this waste, it is included as fine fraction of less than 50 μm; and this waste is considered as a hazardous aluminum waste, among other reasons, because of its poor chemical stability, its spontaneous and exothermic reactivity with water and environmental humidity, generating hydrogen, ammonia, methane, hydrogen sulphide, phosphine, etc. The presence of these phases in the aluminum dross depends on the type of furnace used and above all on the atmosphere inside the furnace, together with the type and quality of the scrap used in each installation. In the first part of this paper, the physico-chemical characteristics and what is the negative impact on the environment and people health of the aluminum hazardous waste, if this is stored in landfill, is presented. Then, some examples of our achievements of how this waste can become a useful raw material for obtaining high value added products, how would be to generate hydrogen as a source of clean energy, getting boehmite, alumina and a harmless environmental residue, is shown. Further, for the development of aluminum dross recycling process, a study on aqueous leaching can offer a new and very interesting economic way. A major problem is the reaction between the AlN amount from the slag and water (vapor or liquid phase), which can produce NH3 gas emission, representing a serious environmental hazard. In the second part of this paper, a leaching process, using water saturated with CO2, is attempted with the aim to retain in situ the ammonia by absorption. The laboratory experimental results highlight that the extraction of K and Na salts from the slag are high (>95 wt%) at a solid slag mass to liquid water ratio of 1:25 and 3 hours of leashing, at room temperature. Also, with a continuous CO2 bubbling at a maximum flow rate of 60 ml/min, the amount of NH3 gas releasing has decreased from 0.3624 mg/l water to <0.0065 mg/l, highlighting the effectiveness of the NH3 absorption in carbonized water (>97%). By comparison with the results obtained during leaching experiments using pure AlN, this shows that the introduction of CO2 is an impediment to the hydrolysis of AlN. The retention of AlN into the leach residue and the leaching only of the salt cake by carbonated water becomes a promising way towards removal and recovery of the salts from aluminum dross and towards the obtaining from the leach residues of the aluminum oxynitride (AlON), a material with very good ceramic characteristics.

Biography

E David is a graduate from Faculty of Chemistry and Chemical Engineering and did MS in Physical Chemistry in Surface and Analytical Chemistry from Babes-Bolyai University, Romania. She serves as a Doctor of Chemical Science, Assoc. Prof. and Head of Department of Carbonic Materials, Composites & Analysis Techniques at National Research Institute of Cryogenics & Isotopic Technologies, Romania. She is author of more than 20 inventions in the field of environment, energy, waste recycling, and materials. The World Intellectual Property Organization (WIPO) awarded her the WIPO prize, both at the International Exhibition of Inventions in Geneva, Switzerland in April 2012 and in Brussels, Belgium in November 2014, for two inventions in the field of Waste Recycling and Clean Energy. She held over 80 lectures at national and international scientific conferences and congresses and has published over 140 scientific papers in prestigious national and international publications. She is Member of the World Academy of Materials and Manufacturing Engineering, Physical European Society and Association of Computational Materials Science and Surface Engineering, Poland. She acts as Reviewer for prestigious international journals like *Journal of Materials Processing Technology, Journal of International Hydrogen Energy, Journal of Hazardous Materials*, and more.

elenadavid2004@yahoo.com

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