Neodymium reduction for magnet manufacture

Jose Adilson de Castro[1], Daniel Rodrigues[2], Marcos Flavio de Campos[1]

[1]UFF, Volta Redonda-RJ, Brazil, [2]BRATS, Cajamar-SP, Brazil,

*e-mail: marcosflavio@id.uff.br

In the case of magnet production, the reduction of rare-earth oxide is necessary. Metallic neodymium can be obtained with reduction in molten salts using fluorides or chlorides. The advantages of using fluorides over chlorides are discussed. Fluorides are less hygroscopic, and this is a very important detail. Another relevant reason is that fluorides are more stable, thermodynamically, than fluorides. When using chlorides, generation of Cl_2 when performing the reduction can decrease the current efficiency. An interesting possibility is obtaining the neodymium-iron alloy, when performing the igneous electrolysis. This can be possible with the use of iron electrodes. The process of neodymium oxide reduction is similar to the Hall-Heroult process for aluminum production. A possible strategy is choosing the proportion of different salts in such way to have low eutectic point, and performing the reduction at lower temperatures. It is presented a mathematical model for the neodymium reduction. The model uses the Navier-Stokes equations and the Maxwell equations for taking into account magnetohydrodynamics. Details as cell size and geometry can be evaluated with the model. One of the problems in the neodymium production are the fumes. The model can help to predict conditions of operation able to avoid formation of fumes. Another important issue in the neodymium reduction is the significant use of electric energy. The model is also helpful for finding conditions of operation for reducing the consumption of electric energy.

FAPERJ, CNPq. CAPES