

## Project Title

Industrial production of Nickel based natural gas reforming catalysts using recovered Nickel from spent catalysts



## Executive Organization

Kharazmi Technology Development

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## Abstract

The presented plan is the industrial production of nickel based natural gas reforming catalysts manufactured from the recovered nickel obtained from spent catalysts. In this plan, pure metallic nickel is recovered and reduced as the cathode upon applying electrical current in the sulfuric based solution of nickel prepared by the leaching of the spent catalysts (catalysts used in DRI, Petrochemical, Refinery and Edible Oil Plants) or through using multiple purification steps on the leached solution obtained from nitric acid. Prior to processing, the spent catalysts are divided into organic compounds containing or non-organic compounds containing categories and based on this classification, different leaching procedures should be utilized on the spent catalysts and ultimately electro-winning techniques would be used to recover cathode nickel. Preparation of nickel sulfate or nitrate solution can be through leaching of the spent catalysts with sulfuric and nitric acid, adjustment of solution pH and subsequent precipitation of the impurities. In electro winning section, the optimization in power consumption and increasing in the performance of nickel cathode production has been carefully considered. The obtained pure cathode nickel is then contacted with nitric acid and the density and concentration of nickel in the nickel nitrate solution is determined precisely. This nickel nitrate solution would be used as the impregnation solution and a variety of porous catalyst carriers such as magnesium oxide, magnesium aluminate, calcium aluminate, alumina and etc. can be dipped inside to introduce the nickel nitrate solution into the carrier pores. The catalyst would be dried in the oven and calcined at high temperatures. The necessary content of nickel can be achieved through multiple impregnation, drying and calcination steps. These catalysts can be used in the NG reformers of DRI, Petrochemical, refinery and hydrogen plants.



▲ Different Types of Nickel Based Natural Gas Reforming Catalysts (left) and All Pure Derivatives of Recovered Nickel from Spent Catalyst used in the Catalyst Manufacturing Process (Right)