



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

Name of the Student : Biswajyoti Das

Roll Number : 126103009

Programme of Study : Ph.D.

Thesis Title:

Experiments and Modelling of Hydrogen Gas Generation from the Reaction of Aluminium-NaOH Solution and its Application in Sintering Furnace

Name of Thesis Supervisor(s) : Prof. P. S. Robi and Prof. Pinakeswar Mahanta

Thesis Submitted to the Department/ Center : Mechanical Engineering

Date of completion of Thesis Viva-Voce Exam : 03/12/2024

Key words for description of Thesis Work : ANN, Aluminium, Hydrogen, Sintering furnace

SHORT ABSTRACT

Hydrogen gas as an energy carrier has high energy density and almost nil emission during its combustion. The production of hydrogen gas from the reaction of aluminium-NaOH solution is a clean method of production. In the present study 1 g aluminium scrap is reacted with aqueous NaOH concentrations of 1M-5M and temperature of water varying from 303 K- 333 K. Mathematical modelling of the hydrogen generation is carried out by using machine learning techniques for large scale applications. Hydrogen gas produced by the chemical reaction is used to heat a sintering furnace and to determine its thermal efficiency. Approximately, 97 % of stoichiometric hydrogen is produced in the condition 5M/333 K which is 1322 ml.g⁻¹ Al. The activation energy of 57.62 kJ.mol⁻¹ is obtained in this work. The hot combustion product of hydrogen-air mixture is introduced inside the furnace to heat up at different fuel-air ratios. The thermal efficiency (η) of the furnace is measured as 76.22 % at fuel-air ratio of 1:60 corresponds to the fuel-air equivalence ratio (λ) of 0.57. Hydrogen gas is an effective energy carrier for power generation which is clean at the same time.