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Optimization of Fe, Mo and Mn on Nickel Mesh for Ammonia Oxidation

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Structured Abstract

Background: The global quest for renewable energy is essential to reducing reliance on fossil fuels which cause environmental pollution, global warming, climate change and an energy crisis. Success in these areas could transform the global energy landscape by promoting renewable energy sources. This study explores importance of catalysts in chemical reactions by using Ni mesh as a support catalyst. The purpose of this study is to prepare Fe/Ni mesh, Mo/Ni mesh and Mn/Ni mesh through electrodeposition and to optimize catalytic electro-oxidation of ammonia by using RSM.

Methods: The metal/Ni mesh catalysts were prepared through electrodeposition technique. Voltage supply, concentration of salt and time are the parameters that being used through this study. The catalysts prepared were characterized by using XRD, FESEM, EDX and TGA. Hence, Nessler's method was used to determine the concentration of ammonia for screening. The Mn/Ni mesh catalyst was selected and undergo for electro-oxidation of ammonia by using RSM.

Results: This study shows that Fe/Ni mesh, Mo/Ni mesh and Mn/Ni mesh were successfully prepared through electrodeposition. The result of characterization and screening indicated that the Mn/Ni mesh catalyst was the most efficient compared to two other catalysts. Based on the screening, the Mn/Ni mesh was oxidized ammonia by 47% at 15 minutes compared to the Fe/Ni mesh catalyst which oxidized the ammonia by 27% at 15 minutes and the Mo/Ni mesh catalyst,23% at 25 minutes. Hence, by using the RSM, the Mn/Ni mesh catalyst was determined that the optimum catalytic activity of Mn/Ni mesh was when the weight loading of Mn on Ni mesh is 16.16% at 4V, 0.2 M of $MnSO_4$ solution and 20 minutes of time.

Conclusion: In conclusion, the Fe/Ni mesh, Mo/Ni mesh and Mn/Ni mesh catalysts successfully prepared through electrodeposition and characterized by using XRD, FESEM, EDX and TGA. Hence, the result of characterization and screening with other catalysts reflected that the Mn/Ni mesh catalyst was the most efficient catalyst among three catalysts. By using RSM, the optimum catalytic activity of Mn/Ni mesh was when the weight loading of Mn on Ni mesh is 16.16% at 4V, 0.2 M of $MnSO_4$ solution and 20 minutes of time.

Keywords: Electrodeposition, Catalysis, Ammonia, Oxidation, RSM

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