One solution to many problems (i.e., depletion of fossil fuels, environmental pollution, global warming and other climate issues) relies strongly on the development of hydrogen economy. A chain system of energy flow such as production of hydrogen (H_2) via water electrolysis and its utilization as a fuel in fuel cell vehicles are the most anticipated aims of hydrogen economy. However, extensive use of costly noble metals or noble metal-based catalysts at the oxygen electrodes of proton exchange membrane (PEM) water electrolyzers and fuel cells has made the hydrogen economy a daydream. On the other hand, by looking at the global environmental crisis, it can be easily realized that the commercialization these technologies is the prime need of the hour, and this can only be achieved by bring down its cost. In order to do so, continuous effort in a war footage mode must be given to replace these noble-metals based materials with a cost-effective material. However, developing and designing such an electrocatalyst isn't that easy and it should follow the conditions mentioned below.

(a) The electrocatalyst should not undergo oxidative damage under operating conditions like high anodic potentials and strongly acidic medium.
(b) The electrocatalysts should be highly active and durable towards oxygen evolution (OER) and oxygen reduction reaction (ORR).
(c) The catalysts must be safe in regards to health and environment.

In the present project, we will design iron (Fe) /nickel (Ni) containing nanostructured materials for efficient and stable oxygen electrocatalysis. The catalytic activity and stability of the materials at different operating conditions will be investigated thoroughly. The relation between catalytic activity and electrode stability in acidic conditions will be established. The desired nanostructured materials will be synthesized by electrochemical methods. The morphology and elemental composition of the materials will be investigated by various sophisticated analytical and spectroscopic techniques. The oxygen electrocatalysis properties of the materials will be investigated in acidic electrolytes by employing a computer controlled potentiostat/galvanostat. Such detailed study of designing of materials with highly active Fe/Ni sites and understanding their activity-stability issues will definitely enrich our knowledge of acidic oxygen electrocatalysis. This may help in a significant way for the future commercialization of PEM water electrolyzers and fuel cells. Therefore, this study is expected to give new impetus to the development of hydrogen economy.