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Theoretical and experimental studies of Nickel (II), Copper (II) and Zinc (II) complexes of 1,10-phenanthroline dione derivatives, a precursor of metal-organic frameworks (MOFs) for solar water splitting

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Theoretical calculations using DFT/B3LYP methods and experimental results were undertaken to evaluate the structural and spectral characteristics chelating ligand 1,10-phenanthroline 5,6- dionedihydrozone (PDDH) in order to assess its potentiality towards metal complex formation, a precursor of synthesized metal-organic frameworks (MOFs). Encouraged by the conclusions from these studies, attempts were made to prepare this material and its Ni(II), Cu(II) and Zn(II) complexes and prompted by the failure to synthesize the ligand PDDH, by the reaction between 1,10-phenanthroline 5, 6-dione (PD) and hydrazine; preparation of Ni(II), Cu(II) and Zn(II) complexes of PDDH was successfully achieved through template synthesis in which each metal complex of PD (in 2:1 mole ratio) in alcoholic solution was treated with hydrazine (in one mole ratio) and characterization of the PDDH and its metal complexes by physical, analytical (C, H. N, Cl and metal), conductance, spectral (IR, 1HNMR, 13CNMR, UV-Vis-NIR), XRD, TGA, SEM and magnetic susceptibility studies was done. The performance and stability of synthesized electrocatalysts were evaluated using cyclic voltammetry (CV) in alkaline condition. Adequate and promising correlations of theoretical and experimental studies were achieved.

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Investigation into acoustical characteristics of power electronic devices used in photovoltaic solar systems

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Photovoltaic (PV) solar systems play key roles in providing clean energy and they are expected to grow in the coming years. Therefore, there is a timely requirement for more reliable PV solar systems to enhance their return on investment (ROI) and attract more financial supports. DC-DC converters are crucial elements in PV solar systems; they are used for conditioning generated electric power and in tracking the maximum power points. However, converter's life cycle is shorter than that for the photovoltaic panels. They are a commonest cause for failures and hence reduce ROI for PV solar systems. This paper presents none contact and inexpensive method to detect failures, at their onsets, in DC-DC converters using their induced acoustic emission signals (AES). An experimental set up was purposely designed and implemented to measure and record AES of DC-DC boost converters under different operating conditions. A 20 kHz to 500 kHz (flat scale on the transfer function graph) transducer was used to measure the AES while driving frequency of devices under testing (DUT) increased from 20 kHz to 300 kHz in steps of 10 kHz. Statistical parameters, such as maximum, root mean squares, standard deviation and kurtosis, were calculated for the measured AES in each test condition. It was concluded that the measured AES carry useful condition related information which could be extracted if suitable measuring devices and analyzing techniques are adopted. The root mean square (RMS) of the measured AES was found directly proportional to thermal profile of the tested devices. More important, the kurtosis of the measured acoustic signals were found to increase when temperatures of DUT were close to total failure points, which was stated in their datasheets.

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