The Production and Characterization of Low Lead Contenting Organic-Inorganic Perovskite Solar Cells

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The main purpose of this study is to prepare low lead content organic-inorganic perovskite solar cell by controlling power conversion efficiency of cell. It proposes the reduction of lead content of organic-inorganic perovskite solar cell. Perovskite is a flexible material that is possible to add many elements in the periodic system (Co^{+2}, Fe^{+2}, Mn^{+2}, Pd^{+2} and Ge^{+2} etc.). Goldschmidt's tolerance factor (t=1) is used to determine which element can be formed stable perovskite structure. The stability and decomposition of perovskite depends on tolerance factor. In the cubic form, the ideal tolerance factor is unity. Therefore, Co^{+2} is selected due the unity of Goldschmidt's tolerance factors, Sr^{+2} is recommended due to similar ionic Radius to Pb, Ca^{+2} that has tolerance factor near to lead based perovskite solar cell, and also the addition of Bi^{+3} is proposed that it is successfully used in the lead free composition of piezoelectric materials. First time in the literature, cobalt ($CH_3NH_3Pb_{1-x}Co_xI_3$) and bismuth ($CH_3NH_3Pb_{1-x}Bi_xI_3$) based organic-inorganic perovskite solar cell will be obtained and their efficiency will be measured. Cell components, photoanodes prepared by spin coated and tape casting, then perovskite structure obtained with adding hole transporting materials and electrodes covered on top of it finally cell is assembled. Electronic properties, band gap and phases of selected composition of targeted cell components will be calculated theoretical first time in the literature. Photovoltaic properties will be measured with standard characterization methods.

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***This work was supported by TÜBİTAK (The Scientific and Technological Research Council of Turkey) through project number 116F073.**