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Optical properties of PZN-4.5PT thin film deposited on silicon nanowires for photovoltaic application

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Perovskite solar cells have become a very hot research topic in photovoltaics community. Since the initial reports on solid state perovskite solar cells with efficiency of 10 % in 2012 [1,2], there has been a rapid increase in the number of publications in this area as well as rapid increase in the reported efficiencies. Certified record efficiency according to NREL now exceeds 22 %. Despite this breakthrough, hybrid lead-halide perovskites are known to degrade due to moisture and heat, upon prolonged exposure to light and are prone to ion or halide vacancy migration, leading to unstable operation of photovoltaic devices. To overcome such difficulties, we oriented our research to inorganic PZN-PT perovskite materials with excellent and stable properties compared to the organic-perovskite ones. However, despite their excellent properties, one of the greatest difficulties to integrate widely such materials in electronic devices is to achieve them in thin films form because of their incongruent melting property.
Our study focuses to integrate PZN-4.5PT as nanoparticles thin film on Silicon substrate and to investigate their structural, optical properties for photovoltaic application. PZN-4.5PT single crystals prepared using the conventional high-temperature flux method were grounded in an agate mortar to obtain a very fine powder. This nanoparticles powder is then dispersed in a gel. After stirring for one hour in a magnetic mixer at low speed, we get a gelatinous solution containing PZN-4.5PT nanoparticles. A thin film is then deposit by spin coating on p-type silicon nanowires fabricated by Ag assisted. After deposition, SEM, AFM and Micro Xray Fluorescence for thin film surface characterization were performed.
Keywords: Perovskite, nanoparticles, thin layer

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