Electrical Properties of Perovskites

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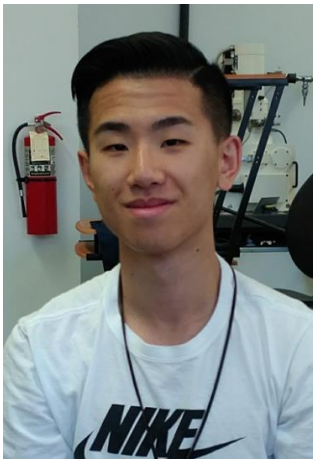
Abstract

Perovskites are a class of compounds that take the form of ABX_3 in which A and B are cations and X is an anion. Hybrid perovskites are perovskites that consist of an organic and inorganic atom. Perovskites are studied because they have been shown to have a high propensity for ionic conduction and have excellent electronic transport properties. This experiment studies the effects of gas and light on electronic properties of perovskites. The perovskites were made by hot casting technique with methyl ammonium and lead iodide. Afterwards a finger pattern of gold contacts was deposited onto the perovskite surface. The ac current resulting from a chopped light source incident on the sample surface was measured. A finite current was observed at zero bias showing that the perovskite has a built-in electric field driving current flow. It behaves as a ferroelectric material. A scan of current vs. wavelength showed a turn on at the wavelength corresponding to the band gap energy. Measurements at fixed wavelength as a function of dc bias were done to determine the built in potential. When the sample was exposed to gas, the built-in potential shifted, showing that the gas exposure modified the ferroelectric properties. The shift increased when the sample was exposed to a bright light source. It is known that perovskites expand under light exposure so it is possible that the combination of light and background gas allows gas diffusion into the sample, modifying the built-in field.

Biography

Jack Wei is a rising junior at Louisiana State University majoring in Chemical Engineering. He is a pianist, basketball player, tennis player, vlogger, photographer, writer, and casual public speaker. He has worked for the University of Louisville and Naval Research Laboratory for REU programs and Science Engineering Apprenticeship programs in the fields of perovskites, java programming, and sediment dynamics.