

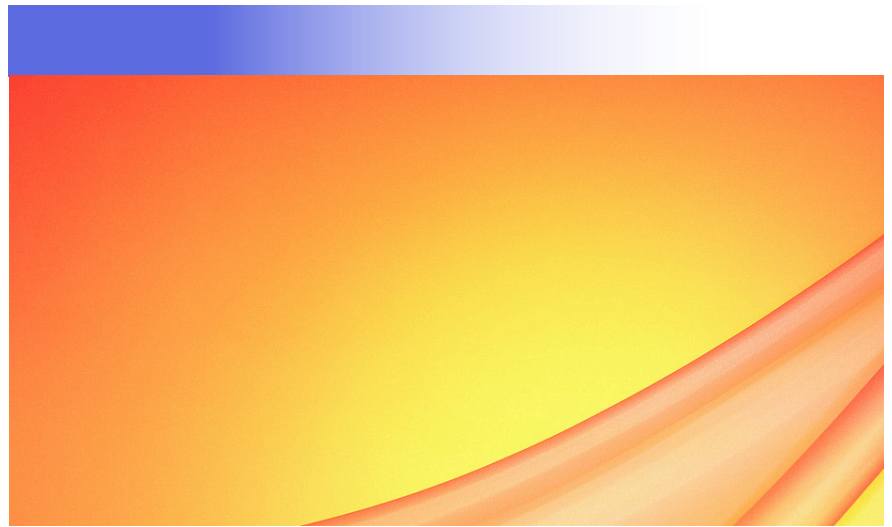
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Ferroelectric Diode and Photovoltaic Devices

Invention Summary: This invention is related to diode and photovoltaic effects in conducting ferroelectrics and pyroelectrics. The diode and photovoltaic devices comprised a singlecrystalline ferroelectric or pyroelectric with remnant electric polarization sandwiched with transparent (or semi-transparent) electrodes. Generally, ferroelectrics and pyroelectrics are highly insulating. In fact, any conduction (i.e. loss term) in ferroelectrics and pyroelectrics is considered detrimental for most of technological applications of ferroelectrics and pyroelectrics. However, we have recently discovered that the conduction in ferroelectrics and pyroelectrics can be associated with new fascinating phenomena – rectification of electric transport current and visible-light-range photovoltaic effects. The rectification direction and also the direction of photovoltaic current is directly related with the direction of electric polarization of ferroelectrics and pyroelectrics. Moreover, the phenomenon of a significant electric conduction with illumination can be utilized for applications with combined photovoltaic and diode effects; for example, light sensor (photo-diode), optical non-volatile memory and

optical MEMS (micro-electro-mechanicalsystem) applications.

Market Applications: Optical sensors, memory devices and solar cells applications with increased power conversion efficiency and thereby better solar energy harvest. A good fraction of modern microelectronic devices are based on the rectification effect of p-n junctions, so our new ferroelectric rectification effect can be utilized to create completely new electronic devices.

Advantages: Compared with solar cell based on p-n junctions, ferroelectric photovoltaic cells may be cheaper and more efficient. Memory devices utilizing ferroelectric diode and photovoltaic effects can have much higher memory density. Optical sensors using ferroelectric diode and photovoltaic effects may have more sensitivity or larger dynamic range.

Intellectual Property & Development Status: A provisional patent application has been filed.