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Metal-Isolator-Graphene Diodes for On-Chip Energy harvesting

On-chip energy harvesting is an emerging field, driven by the demands of mobile sensor systems for autonomous operation. For operation conditions under daylight or indoor light conditions, photovoltaic devices offer an easy and efficient way to cover the energy demands of sensor systems, having the potential of delivering power levels up to 20mW/cm². Recent studies on metal-insulator-graphene diodes (MIG-diodes) have shown that they can operate as photodiodes and photovoltaic devices when quantum dots (PbS) or an inorganic perovskite (CsPBBr3) are deposited on top, while their total device size can be reduced to µm scale, making them ideal candidates for on-chip energy harvesting. Interestingly, MIG-diodes with perovskite exhibit an unconventional photovoltaic effect, i.e. zero bias photocurrent in the forward direction of the diode, unlike conventional silicon-based solar cells.

This poster demonstrates the potential for producing micron-scale photovoltaic devices with different absorption characteristics using MIG-diodes and perovskites for on-chip energy harvesting. For this purpose, organic and inorganic perovskites were deposited onto MIG-diodes and afterwards their optoelectrical properties were investigated. Using CsPbBr3 as the photoactive material, the solar cells yielded an open-circuit voltage of about 1 V, which can further be increase due to serial connections of several devices. Furthermore, perovskites allow the absorption spectrum to be adapted from blue to red by adapting the material composition. This enables the system to be flexibly adapted to different applications and illumination conditions.

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