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Nanomaterials with manageable charge of nanoblocks for adaptive sensing[1] VLADIMIR MITIN, GUILLAUME THOMAIN, ANDREI SERGEEV, NIZAMI VAGIDOV, University at Buffalo, KIMBERLY SABLON, U.S. Army Research Laboratory, Adelphi — Development and implementation of adaptable nanomaterials will qualitatively improve infrared sensing to meet the requirements of various applications. Adaptive sensing substantially enhances real-time detection, tracking, and identification capabilities and simultaneously provides optimal use of sensing resources. 2D and 3D nanomaterials, such as quantum dots and quantum wells, allow for effective control and management of photoelectron processes via charge redistribution in dots and wells. We designed, fabricated, and tested quantum dot and quantum well structures with complex selective doping and/or various coupling between nanoblocks. The results obtained demonstrate that the electric charge of dots and wells may be controlled by voltage bias, optical bias, and gate voltage. The charge redistribution strongly changes photocarrier lifetime, concentration of thermally excited photocarriers, and coupling to IR radiation. These adaptable parameters provide effective ways for control and tuning of interrelated detector parameters: responsivity, sensitivity, acquisition time, and dynamic range.

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Vladimir Mitin
University at Buffalo

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