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Photocurrent imaging and efficient photon detection in a graphene transistor FENGNIAN XIA, THOMAS MUELLER, IBM TJ Watson Research, ROKSANA GOLIZADEH-MOJARAD, ECE Department, Purdue University, MARCUS FREITAG, YU-MING LIN, JAMES TSANG, VASILI PEREBEINOS, PHAEDON AVOURIS, IBM TJ Watson Research — We measure the channel potential of a graphene transistor using a scanning photocurrent imaging technique. In this approach, the photon-induced current between the source and drain is measured when the excitation laser beam is scanned across device at various gate biases. Potential profiles are then inferred from photocurrent measurements. We show that at a certain gate bias, the impact of the metal on the channel potential profile extends into the channel for more than 1/3 of the total channel length from both source and drain sides, hence most of the channel is affected by the metal. The barrier height between the metal and graphene interface is experimentally determined to be around 95 meV from transport and photocurrent measurements. As the gate bias exceeds the Dirac point voltage, V_{Dirac}, the original p-type graphene channel turns into a p-n-p channel. When laser beam from He-Ne laser with a wavelength of 632.8 nm is focused on the p-n junctions, an impressive external responsivity of ~0.001 A/W is achieved, given that only a single layer of atoms are involved in photon detection. The possibility of using graphene p-n junctions in high-bandwidth photonic applications is discussed.

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