Polarized Tamm plasmon lasers

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Plasmonic Tamm states are interface modes formed at the boundary between a distributed Bragg mirror and a metallic layer [1]. Their optical properties lie in between surface plasmons and microcavity photonic modes and make them very promising for new type of lasers. We will describe some features of semiconductor quantum wells coupled to extended Tamm modes, like strong coupling with the excitons and lasing [2]. The main advantage of the Tamm modes lies in the easy confinement of the mode which can be obtained only by structuring the metallic part of the structure, allowing a good control of the size and the emission polarization. The reduction of the mode volume leads to an efficient control of the spontaneous emission (increased beta factor), making Tamm confined structures well suited for single photon emitters and lasers. We demonstrate that confined Tamm plasmon modes can be advantageously exploited for the realization of new kind of metal/semiconductor lasers. Laser emission is studied for Tamm structures with various diameters of the metallic disks which provide the confinement. A reduction of the threshold with the size is observed [3]. The competition between the acceleration of the spontaneous emission and the increase of the losses leads to an optimal size, which is in good agreement with calculations. Polarization effects in asymmetrical Tamm structures will also be discussed.

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