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Development of a nanopolarizer based on plasmonic structures in Er3+-doped tellurite glasses

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The polarization state is a fundamental property of light, and its manipulation exhibits important applications in transmitting information on optical technologies. The development of polarization controllers on the nanoscale with noble materials has attracted the attention of researchers in the last decades. In this scenario, plasmonic structures in thin metals exhibit remarkable properties such as the generation of surface plasmon polaritons (SPPs) and extraordinary optical transmission (EOT), which is a consequence of the SPP-light coupling and can be used for polarization controlling. For instance, the bull's eye nanostructures give rise to beaming with a focusing property on the subwavelength regime. (1) They can be implemented for linear polarization selection modifying the geometry of the aperture. In this research, different plasmonic bull's eye structures were fabricated in gold films on Er^{3+}-doped tellurite glass for linear polarization manipulation at 1.5 μm. All nanostructures exhibit an elliptical aperture, which filters parallel electric field components to their major axis. Here, the Er^{3+} is excited under 980 nm and emits at 1.5 μm. Such wavelength is used in optical communications. Afterwards, the emitted light interacts with the plasmonic structure, where light and SPP couple and generate EOT through the aperture. This EOT is polarized parallel to the minor axis of the aperture. A linear polarizer is at the entrance of a photodetector, and the collected signal obeys Malu's law of polarization varying the polarizer angle. Therefore, the system acts as a nano-polarizer and can be implemented for photonic and signal-processing applications.

Palavras-chave: Bull's eye. Plasmonics. Tellurite glass.

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