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Metasurfaces based on Gallium Nitride High Contrast Gratings at Visible Range ZHENHAI WANG, SHUMIN HE, QIFA LIU, WEI WANG, YONGJIN WANG, HONGBO ZHU, Grünberg Research Centre, Nanjing University of Posts and Telecommunications, Nanjing 210003, China, GRÜNBERG RESEARCH CENTRE TEAM — Metasurfaces are currently attracting global attention due to their ability to achieve full control of light propagation. However, these metasurfaces have thus far been constructed mostly from metallic materials, which greatly limit the diffraction efficiencies because of the ohmic losses. Semiconducting metasurfaces offer one potential solution to the issue of losses. Besides, the use of semiconducting materials can broaden the applicability of metasurfaces, as they enable facile integration with electronics and mechanical systems and can benefit from mature semiconductor fabrication technologies. We have proposed visible-light metasurfaces (VLMs) capable of serving as lenses and beam deflecting elements based on gallium nitride (GaN) high contrast gratings (HCGs). By precisely manipulating the wave-fronts of the transmitted light, we theoretically demonstrate an HCG focusing lens with transmissivity of 83.0% and numerical aperture of 0.77, and a VLM with beam deflection angle of 6.03° and transmissivity as high as 93.3%. The proposed metasurfaces are promising for GaN-based visible light-emitting diodes (LEDs), which would be robust and versatile for controlling the output light propagation and polarization, as well as enhancing the extraction efficiency of the LEDs.

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