DEVELOPMENT OF INTEGRATION TECHNOLOGY OF DIFFRACTIVE STRUCTURES INTO PLASTIC SURFACE OF THE PRODUCTS

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There are various applications where incorporating a hologram or a different light-diffracting surface relief pattern onto the exterior of a molded plastic component is advantageous to ensure the authentication of the product. It is important to develop techniques for widespread mass replicating plastic articles, with microstructures on their surfaces through injection or blow molding using a unitary mold piece in the shape of the object, with the hologram integrally formed on its inside surface. These microstructures can be formed through various techniques including attaching metal film replicas of holograms to the model, electrodeposition directly on a model with a surface relief pattern or forming the hologram directly on the model's surface using photosensitive materials [1-3].

In our research, diffractive elements were made from the creation of a unique graphic design to the final product – an original hologram with special security elements. The full hologram production cycle was used: mathematical modeling of diffractive structures, recording of the original hologram by dot-matrix technique, silver vacuum evaporation, electrochemical deposition of nickel master, and recombination. To achieve this, the design of the configuration of diffraction structures (arrangement of geometric figures, texts, symbols, selection of diffraction optical effects) and the investigation of the formed hologram were carried out, choosing the optimal constants of diffraction gratings, the parameters of the angular and spatial orientation of marks formed by diffraction means. Holograms have been thoroughly studied in terms of their morphology, structure, composition, mechanical and other properties. The overall goal is to improve the replication of surface relief holograms on molded plastic parts, offering authenticity and suitability of the production, which meets the global level, for its certified production.

[1] Dan Chen et al. Advanced Materials 2022, 34, 2200903.
[2] X. Wang et al. Optics and Laser Technology 2021, 135, 106687.
[3] Yangxi Fu et al. Scientific Reports 2020, 10, 22428.