Supplementary Materials

S.1. Circular laser writing system (CLWS-300IAE)

Experiments on the thermochemical formation of surface structures on the investigated bi-layer Si/Ti films were carried out by direct laser writing on a circular laser writing system (CLWS-300IAE). Figure S1 shows a simplified diagram of this system. CLWS-300IAE allows laser writing in polar coordinate system (R, φ) and is designed for operational writing of diffractive optical elements on substrates up to 250 mm in diameter and up to 24 mm thick. As a source of radiation for laser writing on this system, a continuous-wave DPSS laser with a wavelength of 532 nm and a maximum power (P) of 2 W is used. The laser power is controlled by the CPD photodetector (Figure S1). The PPD photodetector is used to control the reflection from the sample and makes it possible to register the change in the reflection from the original film deposited on the sample and from the material locally modified under laser irradiation. The autofocus system (AF), which includes a focusing sensor and a controller, ensures the correct and constant position of the focused laser writing beam on the sample. This is achieved by controlling the lens position of the focusing objective. Preliminary analysis of the structures written on the setup and selection of the optimal power parameters of the laser writing beam can be carried out using reflected light images obtained with the installed digital CCD camera. For illumination during image registration by the CCD camera, an LED illuminator of the sample surface is used. During the experiments, the samples, which were flat fused silica substrates with sputtered Si/Ti films, were fixed on a faceplate connected to a precision spindle with an air bearing. The spindle speed in the experiments was 12 revolutions per second. The write speed (V) of the test structures was controlled by changing the position of the laser beam along the radius on the substrate. The diameter of the focused laser writing beam in the experiments was 0.7 μm (FWHM).

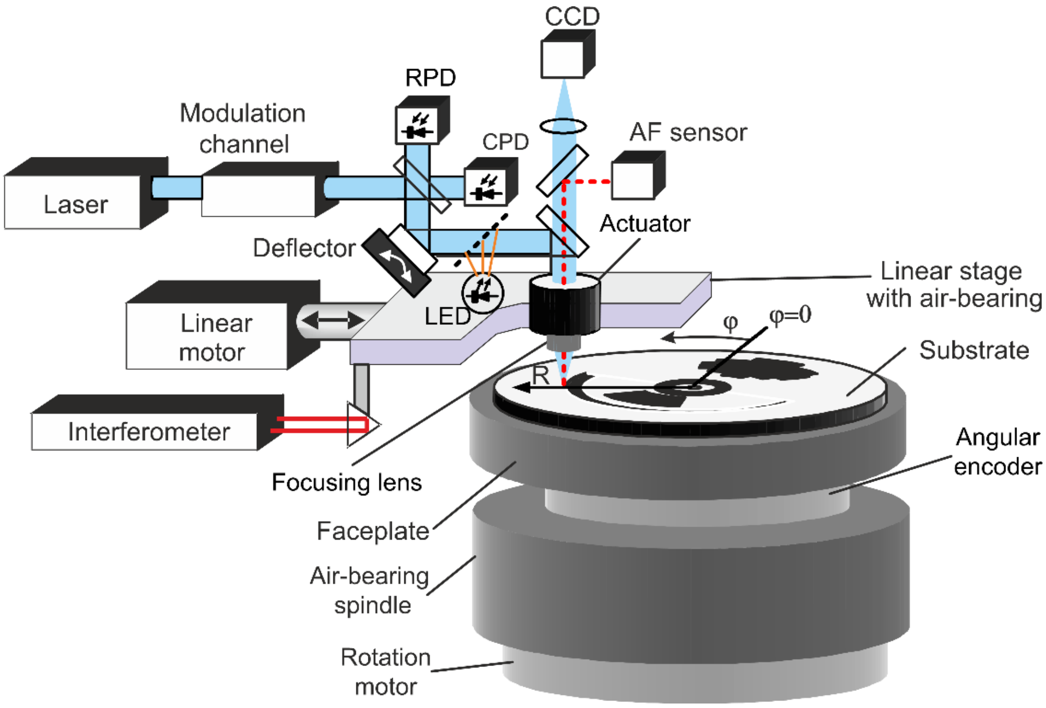
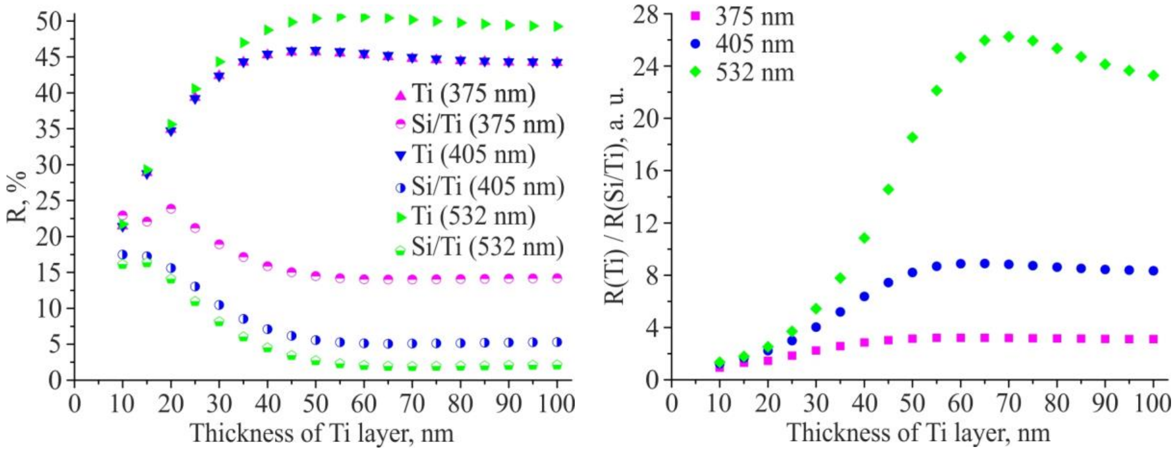


Figure S1. Simplified circuit of the CLWS-300IAE.

S.2. Reflectance characteristics of films Ti and Si/Ti

Figure S2a shows the reflection coefficient (R) values of a bi-layer Si/Ti structure compared to a Ti film. The thickness of the capping layer of silicon in the simulation corresponds to the thickness of the achievement of maximum absorption by the bi-layer Si/Ti film at the calculated wavelength. Figure S2b shows the reflection coefficients ratio of a Ti film to a Si/Ti film. It can be noted that for the studied wavelengths, the maximum difference between R(Ti) and R(Si/Ti) is achieved at a wavelength of 532 nm. For this wavelength, at a thickness of Ti = 70 nm, the decrease in reflection from the Si/Ti film is by factor of ~26 times. At the same time, at a wavelength of 375 nm, it is possible to achieve a decrease in reflection only by factor of ~1.62, and at a wavelength of 405 nm by factor of ~8.9.



(**a**) (**b**)

Figure S2. Reflectance characteristics: (a) Comparison of R(Si/Ti) and R(Ti); (b) Ratio R(Ti) / R(Si/Ti).

S.3. Reflectance spectra of Si/Ti films depending on the thickness of the capping Si layer

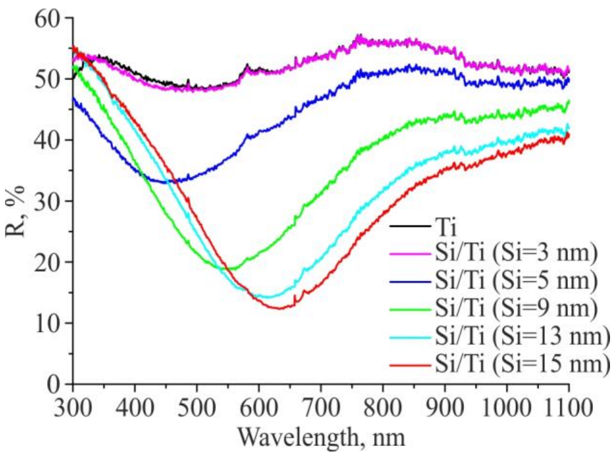


Figure S3. Reflectance spectra of Si/Ti films depending on the thickness of the capping Si layer.

Figure S3 shows the Reflectance spectra of Si/Ti films depending on the thickness of the capping Si layer. During the preparation of these samples by the method of magnetron sputtering technique, a Ti layer 50 nm thick was first deposited on a heated fused silica substrate (thickness 1 mm, diameter 25.4 mm) in a vacuum atmosphere, followed by a Si layer. The deposition rates of Ti and Si films were preliminarily measured, and during the formation of samples of bi-layer Si/Ti films, the thickness of individual layers was controlled by the time of their sputtering.