**Piezoelectric resonator for temperature measurement of metal-dielectric heterostructures interacting with laser radiation**

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An investigation of the interaction with laser radiation of thin metal films deposited onto the dielectric substrates is of great interest in the fields of nanophotonics and plasmonics. We propose to use the temperature dependence of the eigenmode frequencies of the substrate for measuring the overheating of various metal-dielectric heterostructures under laser irradiation. In the case the substrate is made of a piezoelectric material its eigenmodes can be excited using probe radio frequency electric field. Two electrodes should be employed in order to form a capacitor with piezoelectric substrate in between. A piezoelectric resonance occurs when the frequency of the external electric field corresponds to any eigenmode frequencies of the substrate. During laser irradiation the heating of the metal film can be determined by measuring the induced shifts of piezoelectric resonance frequencies.

The temperature calibration of the resonance frequencies is preliminary performed in uniform heating conditions. In the first approximation, resonance frequencies linearly depend on temperature: , here  is the piezoelectric resonance thermal coefficient of the *i*-th eigenmode.

During the interaction with laser radiation of the average power *P* the induced frequency shift corresponds to the change of the equivalent temperature  of the heterostructure. Consequently, the temperature of the metal film can be restored.

The introduced approach was corroborated experimentally using the lithium niobate crystal substrate coated with gold and different UV and visible laser sources.