Angle and axial displacements of dielectric fiber in quasi-optical resonator transformer

Vitaly V. Bessonov,[*] Igor. O. Dorofeev[†]

National Research Tomsk State University, Tomsk, Russia

To achieve high sensitivity radio wave diagnostics of thin threadlike objects resonator methods should be used. In the centimeter band of wavelengths devices for non-contact control of ultrathin conductors were created, in which open resonators were used as the sensor-transducer. However, for all resonator methods a significant drawback is the dependence of the sensor output signal on the position of the object. There are several ways to reduce the impact of this factor. The first way is a slope change of an object relatively a resonator axis. The second way is use of several main modes forming a common signal of the transformer.

In present work the main characteristic of the resonator sensor is steepness of the change transformation of the sample diameter into a shift change of the resonant frequency of the corresponding wave mode *S* (MHz /mm).

Measurements showed that the steepness of transformation decreases from 13.8 to 6.9 MHz /mm at the rotation angle of more than 15^{o}. At application of the second method, measurement results showed, that the lateral displacements of the sample within ± 2 mm practically do not affect on a the total frequency shift of the two modes. Wherein the value of transformation steepness does not decrease, since the object remains in a position close to the orthogonal axis of the open resonator.

From the obtained results, it follows that reduce the impact of dielectric thread-like sample position on results of resonator sensor conversion of its diameter can be achieved either by inclination in the plane of the electric field vector, or by using the double -mode regime. Wherein in the first case the steepness of the transformation decreases. The second case is more difficult from a technical point of view, since it requires a two-frequency source. The choice of method depends on the specific requirements for the diagnostic device.

[*] E-mail: bessonov_vitaly@mail.ru
[†] E-mail: idorofeev@mail.tsu.ru