Abstract

Evaluation of the most important information and observation changes or occurrences that introduce the deposition of external materials into the fiber optic taper area, on the properties of the propagating light beam is the aim of the project. The aim will be achieved by carrying out basic research on various types of fiber optical taper with additional materials to create a cladding / surrounding of taper. Such a combination of elements will make it possible to observe changes in light beam transmission in the structure of the fiber optic taper depending on the influence of external physical, chemical or biological factors. In the project we will investigate the connections of optical fiber tapers with liquid crystals and mixtures of higher alkanes with Au metal nanoparticles. Selection of liquid crystal materials was dictated by their anisotropic optical properties, the ability to modulate the refractive index as a result of varying applied voltage. In addition, the interesting effect should be obtained with the temperature changes resulting from structural modifications from the liquid crystal to the isotropic liquid - which is also associated with a change in the refractive index. Basic research will also be carried out on the combination of higher alkanes and nanoparticles. Spectral / transmission characteristics and their variations will be investigated using different temperatures for wide wave range. Higher alkanes are characterized by solid-liquid phase transformation, which also affects changes in the environment that detects by the optical fiber taper. The use of Au nanoparticles should give interesting effects due to the phases changes (as additional crystallization centers).

Optical fiber taper is describe by three characteristic areas. Untapered area, transition area and taper waist. The transition area is responsible for the loss, while the taper waist enables the interaction of the beam propagating in the fiber to the environment/external materials. Known fiber optic fabrication technology allows to consciously obtain the appropriate parameters for these areas - the length and diameter needed for the measurements to be made. This is because the proper configuration allows the connection with additional materials in a way that allows the impact of variations on the propagation of the beam to be assessed. Optimized parameters should be optimized during the initial tests to achieve the best possible results. Fiber optic fabrication technology has also been developed and described in the Department of Applied Physics of WAT. The set-up FOTET (Fiber Optic Taper Element Technology), which uses as a heating element a low pressure burner from a mixture of propane-butane-oxygen gas, makes it possible to make optical fiber tapers diameter less than 10μm. For the construction of liquid-crystal cells with optical fiber taper, a position will be created with optical loss control and bonding of materials from selected areas. The combination with a liquid crystal is associated with the construction of a liquid crystal cell, consisting of layers with layers that orientate the structure of the selected material and the conductive layer of the ITO. When the constriction will be combined with a mixture of higher alkanes and nanoparticles Au, the protection will be glass capillary. The next stage will be the construction of appropriate optical systems and testing transmission, polarization or temperature.

The combination of fiber optical taper with different materials allows many interesting phenomena to be able to detect various chemical, biological and physical factors. Carrying out basic research will allow you to explore the knowledge and information on the interaction of light beams with different materials. Provided research will allow for development of the scientific field, classification of information about phenomenon that occur during measurements well as contribute to the advancement of the use of new materials or technologies at the interface between the two scientific fields optical fiber technology and material science. In addition, developing knowledge on this subject allows us to compete with other scientific units.