

Research and development activities at Fiber Optics and Photonics Division from viewpoint of development of specialty optical fiber and fiber-based photonics devices

Abstract

In early eighties research in fiber optics was initiated through creation of state of art facility for fabricating optical preforms by MCVD (modified chemical vapour deposition) technique and subsequently drawing of commercial grade fibers in Fiber optics and photonics division (FOPD) of central glass and ceramic research institute (CGCRI), Kolkata, India. The main focus was application oriented research particular emphasis on optical telecommunications and photonic components. The initiative has evolved into a sophisticated facility for producing specialty optical fibers for important applications having appreciable market potential. The R & D work on fiber development is well supported by a comprehensive characterization facility to study different geometrical and optical properties of preforms and fibers. FOPD has established a purpose-built facility at Central Glass and Ceramic Research Institute (CGCRI) comprising modified chemical vapour deposition (MCVD) system, dual coated fiber draw tower, a complete fiber characterization set-up, fiber-Bragg-grating writing and WDM test bed. The modified chemical vapour deposition (MCVD) unit is unique in its design in the sense that it can be used both for R & D work and production of preform on a semi-commercial scale. A full range of characterization facility is available at FOPD for preform and fibres. Different varieties of preforms and fibres fabricated are characterized for their geometrical and optical properties e.g. core-clad dimensions, concentricity, mode field pattern, RI profile, NA, attenuation spectrum as also the concentrations of various dopants and their distributions. Although fabrication of specialty optical fibers is the foundation of all fiber based research in our laboratory, it has expanded its activities in a number of key areas in the field of amplifiers, lasers, supercontinuum generation in Photonic Crystal Fiber (PCF) and Bragg grating Sensors. Basic research has been initiated on plasmonics, meta-materials and fabrication of hollow core photonic band-gap fiber. Active and effective collaborations with industries and academic institutions in India and Abroad have greatly facilitated the growth of our Division at CSIR-CGCRI. The mission of our research involved: (i) To achieve excellence in applications oriented research in the areas of specialty optical fibers and fiber optic based components and devices. (ii) Work in partnership with other institutions in the area of fiber optics & photonics and to strive for industrial tie-ups. (iii) Undertake training and consultancy in the areas of core competences. (iv) Continuous training of our manpower to keep pace with fast changing technology. The main area of our research in the field of specialty optical fibers involved: Rare earths doped (Er/Yb/Tm) fibers for optical amplifiers, Large core double-clad rare-earth doped fibers for fiber lasers, Bi and Cr doped fibers, Highly non-linear PCF for supercontinuum generation, Hollow-core PCF and nano-metal doped fibers, Polarization maintaining fiber for sensor, Photosensitive fibers for writing Fiber Bragg-gratings, Radiation soft fibers for dosimeter applications, Radiation resistant fibers for nuclear environments. In the area of fiber based devices and components involved Fiber Amplifier for CATV, Free space communications and FTTH, Fiber laser at 1.0 micron both CW and Pulsed laser, High power CW laser at 2.0 micron, Fiber based supercontinuum sources, Fiber Bragg-grating based Sensors for Structural health monitoring, Detection of gases, chemicals and biological species.