P-28 Organosoluble polyimides and aromatic polyamides as the optical fibre coatings

Bato Bayminov[1], Dmitry Sapozhnikov[1], Nadezhda Popova[1], Sergey Semjonov[2], Alexey Kosolapov[2], Yakov Vygodskii[1]
[1]Russian Academy of Sciences, A.N. Nesmeyanov Institute of Organoelement Compounds, Russian Federation
[2]Russian Academy of Sciences, Fiber Optics Research Center, Moscow, Russian Federation

For high-performance optical fibers exploited in aggressive environment conditions and high temperatures of up to 300°C and above (oil and gas wells, sensors in spacecraft) special protective polymer coatings are needed [1]. One approach to solve this problem is to use protective polyimides (PI)coatings. Commonly the formation of PI coating is based on the use of hydrolytically and thermally unstable precursors, such as poly (amic acid)s (PAAs), which undergo imidization reaction upon coating formulation. This is accompanied by a number of drawbacks including PAA incomplete cyclization, a few solution deposition cycles, storage of PAA solution at reduced temperatures and so on. Moreover, a majority of the known PI's coatings has insufficient adhesion to the quartz fibre. The aim of this work is the elaboration of new types of organosoluble polyimide and polyamide coatings, which will eliminate the difficulties mentioned above.
We present the results on the fabrication of new optical fibre coatings from cardo (co)polyimides [(co)PI] and (co) polyamides [(co)PA] differed in improved heat resistance with organosolubility [2].
The obtained polymers have a wide range of molecular weights (η_{inh} =0.3÷1.8 dl/g) and thermal characteristics: 285°Cg<390°C; 420°C 10%<565°C (in air). Cast polymers films have high tensile strength (85 ÷ 140 MPa) and elasticity modulus of (1100 ÷ 2800 MPa).
The optical fiber coatings were produced from the varnishes of synthesized polymers in N-methyl-2-pyrrolidone (N-MP) with or without a coupling agent. It was established the optimum dynamic viscosity range necessary for the formation of a high-quality coating is 2.4 ÷ 18 Pa × s.
The as-prepared fibres with smooth polyimide coatings without any visible heterogeneity or flaws have high bending strength (~6 GPa) with small scatter [3]. The produced optical fibers are characterized by high thermal stability: their bending strength after holding at 300°C (72 hrs) and 350°C (1 h) is more than 90 % from initial one. It was observed the developed polyimide coatings exceed the commercial product (Ceram Optec) by the hydrolytic stability. Fabricated fibres with smooth (co)PA coatings demonstrated the similar tough and thermal stability.
Significant advantages over the existing technology are the possible coating formation by one deposition cycle with needed thickness (~ 5 microns), disposal of chemical transformation during the coating fabrication and as a consequence the absence of defective PAA fragments, there is no need to store the polymer solutions at low temperatures.
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