yStudon gradd-inedex multimode optical fibres in the system P_2O_5 - SiO_2

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Preparation and properties of graded-index optical fibres of B_2O_3-SiO_2 clad and P_2O_2-SiO_2 core were studied. Attenuation in the optical fiber prepared by an automatically controlled CVD technique is as low as 2.1–3.1 dB/km at $\lambda=0.85$ μm. and 2.0 dB/km at 1.06 μm. The refractive index profile with profile parameter $\alpha=1.95\pm0.1$ has been obtained and the lowest pulse dispersion is 0.56 ns/km.

The various factors which cause attenuation in optical fibre were discussed. Attention were greatly paid to the effects of transition ions in halide raw materials and of moisture in carrier gases. By means of comparing the calculated impurities content and measured data in optical fibre preform, we have succeeded in establishing the impurities level in starting materials by which fibres with attenuation of 3–5 dB/km can be prepared.

According to the power law of optimum model dispersion suggested by D. Gloge, dopant concentration in the core was found to increase linearly with the number of deposited layers. Experimental results revealed in the P_2O_5-SiO_2 graded fibers that the linear relationship holds at $P_2O_5<16$ mol % and thus optical fibers of ~ 2 have been prepared. As $P_2O_5 > 16$ mol %, their linear relationship becomes no longer available and some modifications must be made. Using a modified deposition program, optical fibres of an ideal refractive index profile of $\alpha=1.95\pm0.1$, pulse dispersion $=0.56$ ns/km and bandwidth >400 MHz • km (3dB) were also obtained.

A rationalized coating processing has been developed using UV-cured acrylic expoxy resin. The smallest breaking force of single fiber among 50 fibers fabricated by a high quality quartz support tube and fire polishing is larger than 3 Kg at measurement length of 0.5 m and strain rate of 0.04 min. Average strength reaches to 3.8 GN/m², which may be reasonally thought to satisfy the needs of screening test for long optical fibers. The strength of fibers and the causes of low strength have been analysed.

The alove optical fibers have been successfully in PCM 120, 8.448 Mb/s 1.8 km oplical communication system.

多模梯度型磷硅系光导纤维的研究

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研究了用气相沉积法制备磷硅系梯度型光纤工艺及性能。确定了 B_2O_3–SiO_2 皮、P_2O_5–SiO_2芯石英光纤合理的组成范围及工艺条件。推荐了三种规格 P_2O_5–SiO_2 光纤。光纤最低损耗稳定在 2.5～3.0dB/km(λ=0.85μm)，2.0dB/km (λ=1.06μm)。获得了折射率剖面参数 $\alpha=1.95\pm0.1$ 的光纤，脉冲展宽值最低为 0.56ns/km。

分析了引起光纤损耗的各种因素，重点讨论了卤化物原料中过渡金属离子和载流气体中水分等因素对损耗的影响。从计算和实测坯棒中的杂质含量作了对比，确定了制备损耗 3～5dB/km(λ=0.85μm)的原料纯度要求。

指出：根据 D. Gloge 提出的最佳模色散的梯度型波导结构的功率定律推算得掺杂剂浓度与沉积层数呈线性递增的关系 $C=C_0(1-ki)$。对梯度型 P_2O_5–SiO_2 系光纤，此关系有个适用范围。当 P_2O_5 含量≯16 mol %时，上述关系能够满足，可制得折射率剖面参数 $\alpha=2$的光纤。当 P_2O_5 含量＞16 mol%时，上述关系必须进行修正。本实验获得了较理想的修正值，得到了 $\alpha=1.95\pm0.1$ 的理想折射率剖面。

利用光固化丙烯酸环氧树脂发展了比较合理的一次涂厚的抽涂法工艺。对质量较好的石英衬管和火抛光制造的光纤在测量长度 0.5 米，应变速率 0.04 分条件下，50 根试样的单线破断力大于 3 公斤，平均强度达 3.8GN/m²，能顺利通过长光纤筛选。并对纤维强度特性及低强度原因进行了分析。

上述光纤成功地用于 PCM 120,8.448Mb/s，1.8km 光通信系统中。