intensity, so we can make a self-checked fiber-optic temperature device (Wade *et al.*, 2001; Sidirogiou *et al.*, 2003; Wade *et al.*, 2003; Castrellon-Uribe *et al.*, 2002).

2. Basic principle

The mechanism of the fluorescence temperature measurement is based on this basic physical phenomenon of the photoluminescence. The so-called photoluminescence essentially is the superthermal radiation luminescence when some materials are stimulated by ultraviolet, visible or a certain form of the infrared electromagnetic radiation. This kind of luminescence is a way that the incident photons release their energy that the materials absorb. It may be fluorescence or phosphorescence, or both. After the stimulating light disappears, the duration of fluorescence is determined by the excited state lifespan (Castrellon *et al.*, 2002). This kind of luminescence usually fades away exponentially. The time constant of the exponential reduce can be used as a measure of the excited state's lifespan and is called fluorescence lifespan or fluorescence decay time (Paez and Strojnik, 2003).

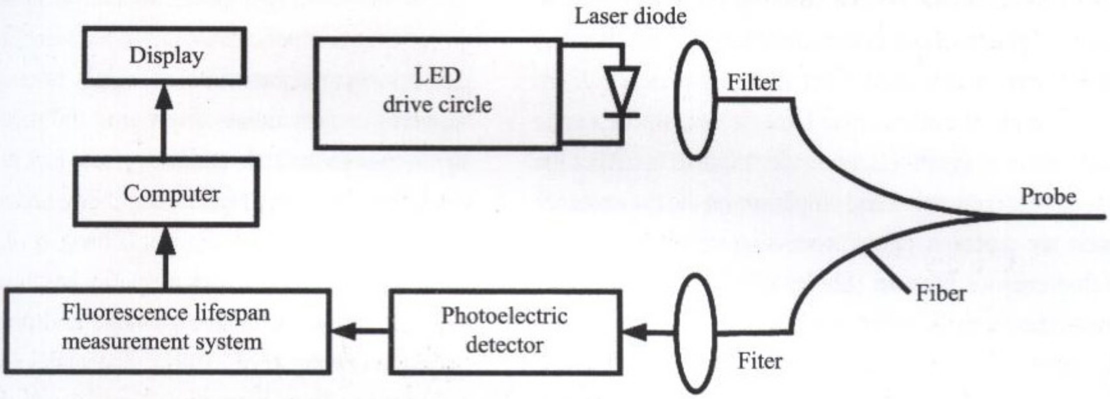

Fig. 1. The system of fluorescence thermal measerement.

The system of fluorescence thermal measurement is show in Figure1. Most materials' fluorescence lifespan used for fluorescence temperature measurement is long. Its fluorescence corresponds to those permissive transitions between electron energy levels in materials. Those transitions release the energy of electrons that are stimulated by incident light (Paez and Strojnik, 2003; Bosselmann *et al.*, 1984). This is a way that electrons return from excited state to the ground state, which causes materials to luminescence. Any available competitive process can shorten the excited state lifespan. Because many competitive processes exist at the same time, some of them can generate light but some cannot luminescence. Therefore the fluorescence lifespan and fluorescence strength of all fluorescence materials will imply some temperature correlation within some homologous temperature. The temperature correlation is right the mechanism of fluorescence temperature measurement (Reule and Schroeder, 1986).

3. Research method

Because of the separation of the fluorescence temperature response elements form the fiber optic bundles, the quartz fiber-optic fluorescence temperature sensor head must be optically gummed together, and more complex outer protection is required to reinforce the mechanical robustness and stability which make the sensor head thermal inertia enlarged and the dynamic response worsened (Vergara *et al.*, 1999). At the same time, because components of quartz fiber-optic are subjected to the fluorescence work temperature, they must be coated with the precious metals, which, however, still cannot be applied in the case of higher temperature. A sapphire optic-fiber has the good properties in physics and chemistry, such as melting point being as high as 2045℃, good optical entrance rate near infrared, and good high-temperature optic-fiber material. We use a laser to heat a small pedestal, so that fluorescence-temperature -responsing materials like a small ruby crystal optic-fiber will grow on the top of the