

400 nm when the fiber is exposed to UV light may be related to this process. However, a previous experiment using pulsed 242 nm light<sup>1</sup> observed constant fluorescence during Bragg grating formation in Ge-doped fiber. We have characterized the time and intensity dependence of the 400 nm fluorescence produced during exposure of the same type of fiber to cw 244 nm light. In contrast to ref. 1, we find that the fluorescence changes dramatically with time and has a time dependence which is similar to that of the index change we measured in our earlier study of Bragg grating formation.<sup>2</sup>

We produce 50 mW of cw 244 nm light by frequency-doubling 488 nm argon-ion laser light in an external cavity. We first measured darkening of the fiber at 488 nm due to exposure with UV light. We focused the 244 nm light on the side of the fiber, illuminating a 7 mm length. The transmittance of the 488 nm light guided in the fiber was reduced by 40% at the beginning of the UV exposure and gradually recovered during the exposure. To avoid modification of the signal by the time-dependent darkening of the fiber, the UV-induced fluorescence near 400 nm was collected from the side of the fiber rather than the end. A mirror with high reflectance at 244 nm and a colored glass filter were used to prevent scattered UV light from reaching the detector.

Figure 1 shows the detector signal for a 4 min exposure. The time evolution of the fluorescence does not follow an exponential decay, but can be characterized by a power-law dependence of the form  $F(t) = F_0(1 - Ct^b)$ , where  $F_0$  is the fluorescence at the start of the exposure,  $C$  and  $b$  are constants, and  $t$  is the exposure time. For data with UV intensities between 1.5 W/cm<sup>2</sup> and 30 W/cm<sup>2</sup>, we find that the initial fluorescence  $F_0$  varies approximately linearly with intensity. The best fit for  $b$  ranges from 0.2 to 0.3. This is very similar to the time dependence that we measured for the index of refraction change,  $\Delta n \approx Ct^{0.3}$ , in this type of fiber.<sup>2</sup> The fluorescence data can also be fitted with a stretched exponential  $F(t) = F_0 \exp(-at^\beta)$ . We obtain the best fit to the same data for  $\beta$  ranging from 0.28 to 0.33. This can be compared to the value of  $\beta = 0.302 \pm 0.039$  obtained using pulsed 266 nm light with relatively low average power.<sup>3</sup>

The difference between our results and those of ref. 1 is surprising. It is possible that the mechanism responsible for UV-induced index of refraction change is different depending on whether cw or pulsed light is used.

1. V. Mizrahi, R. M. Atkins, *Electron. Lett.* **28**, 2210 (1992).
2. H. Patrick, S. L. Gilbert, *Opt. Lett.* **18**, 1484 (1993).
3. M. Poirier, S. Thibault, J. Lauzon, F. Ouellette, *Opt. Lett.* **18**, 870 (1993).

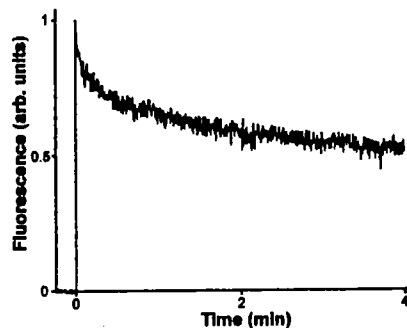
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#### Comparison of UV-induced fluorescence and Bragg grating growth in optical fiber

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The physical process which gives rise to UV light-induced index of refraction changes in Ge-doped optical fibers is not well understood, but is thought to be related to the depletion or generation of color centers in the glass. Fluorescence produced near



CWK5 Fig. 1. Decay of fluorescence near 400 nm when Ge-doped fiber was illuminated with approximately 30 W/cm<sup>2</sup> of UV light over a 7 mm length. The total exposure time was 4 min.