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OPTICAL PROPERTIES OF POLYIMIDE-COATED CAPILLARY TUBING

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Synthetic fused silica capillary, with its outer coating of durable polyimide, has become a widely used tool in the separation sciences. In this application note, we share recently acquired data on its optical properties, with a focus on fluorescence.

INTRODUCTION

Scientists use fused silica capillary tubing routinely in a wide range of analytical applications. Techniques such as GC, CE and Capillary LC continue to take advantage of the capillary's many unique properties. It remains the material of choice for transfer lines, interfacing in hyphenated techniques, and monolithic based separation columns. Polyimide coatings can withstand the high temperature cycling demanded by most GC methods. When applied properly, they provide outstanding durability, which is essential for the routine handling involved in GC coiling, CE column and array fabrication, and Capillary LC column production.

A number of users have inquired about the optical properties of polyimide-coated tubing, with keen interest in the polyimide coating itself. Transmission through polyimide is observed down to about 450nm(1). The fluorescence properties of the polyimide can interfere with some applications. In fact, for applications such as CE, the polyimide is removed to optimize on-column detection, this product often being referred to as windowed capillary. This note investigates and summarizes the fluorescence properties of polyimide-coated capillary and related tubing products.

EXPERIMENTAL

The capillary tubing products used in this study included TSP050375 and TSP050375 with a 5mm long, laser ablated window (Polymicro Technologies, Phoenix, AZ). The specified coating thickness for these products is 20µm.(2) Rhodamine B (Fisher Scientific, Pittsburgh, PA) was dissolved and diluted in water to form a 1mM solution and introduced into the capillary for use as a comparative fluorescence standard.

488nm laser light from a modified Microarray Scanner (Amersham Biosciences, Sunnyvale, CA) fitted with a 500µm core optical fiber assembly (Polymicro) was focused on the capillary outer surface at an incidence angle of 135°. The spot size was approximately 200µm and the measured power 1.39mW. Emitted light was routed to a USB 2000 Spectrometer (Ocean Optics Inc., Dunedin, FL) through a 600µm core fiber optic assembly (Polymicro) fitted with a 500nm cut-off filter (Amersham). Emission spectra were imported into Excel for display.

RESULTS

Spectra were collected from each of the following samples as described: A) the polyimide coating on TSP050375 with no solution inside, B) the detection window of TSP050375 with no solution inside, C) the detection window of TSP050375 filled with the Rhodamine B solution, and D) the polyimide coating on TSP050375 when filled with the Rhodamine B solution. The resulting fluorescence data collected is shown in Figure 1. Data suggests that the polyimide coating on TSP050375 yields a maximum emission intensity nearly equivalent to the emission from a 1mM Rhodamine B solution injected into the 50µm ID of that same capillary. Further, under these experimental conditions, no fluorescence was detected in the silica substrate itself.

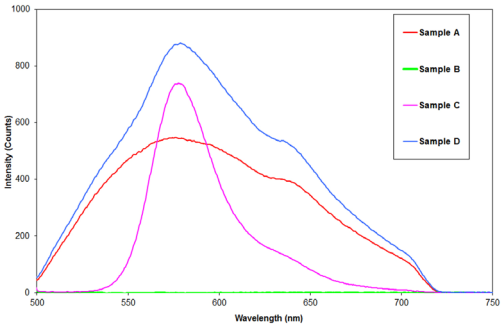

Figure 1: Fluorescence emission spectra collected in this study.

CONCLUSION

The data presented in this application note provides a measure of the fluorescence of the polyimide coating on synthetic fused silica capillary tubing as compared to the commonly used standard Rhodamine B. For additional information, contact Polymicro Technical Sales.

REFERENCES

(1) Data on UV transmission was obtained from Mr. Gary Nelson, Polymicro Technologies, LLC.

(2) "Flexible Fused Silica Capillary Tubing," The Book on the Technologies of Polymicro, Polymicro Technologies LLC Publication (2002)

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