



UV Transparent Fluoropolymer Coated Capillary Tubing

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Synthetic fused silica capillary tubing that has been externally coated with UV transparent Fluoropolymer offers a unique tubing construct of growing importance in the separation sciences. This application note provides an overview of this tubing's properties and key application areas.

Scientists have been using fused silica capillary tubing in GC for nearly 30 years. The outer protective coating of polyimide is ideal for this application due to its remarkable thermal stability and abrasion resistance. As other capillary technologies such as CE and Capillary LC have evolved, the basic tubing construct has remained unchanged. One of the few exceptions to this design has been the application and usage of Fluoropolymer coated capillary. First introduced for use in CE, its unique properties are making it a staple for a number of emerging analytical techniques.

Polymicro launched the Fluoropolymer coated capillary in the late 1980's. This tubing family is commonly referred to as the TSU series and is supplied world wide (1). Its unique properties have allowed it to become a key component in instrumentation for spectroscopy, sensing, and chromatography. Its properties and applications will be discussed.

Properties

The TSU series of tubing, like most other capillary, has two fundamental components. The silica substrate is high purity synthetic fused silica. Polymicro uses the same silica as is found in other small internal diameter (i.d.) capillary products (i.e. TSP series); thus no difference in the i.d. chemistry is expected and bonded phases produced have proven equivalent.

The second component is the outside coating, which is comprised of a thin layer of Teflon®AF (2). It is this component that distinguishes the TSU series from the TSP series. Summary comparisons of properties of the two types of capillary are found in Table I.

Applications and Discussion

The UV transmission properties of the Fluoropolymer have been exploited widely for photo initiated synthesis of monolithic columns for Capillary LC. A good summary of monolithic technologies is provided by Svec (3).

The lower Refractive Index (RI) of the coating in comparison to the silica allows the capillary to function as a light guiding conduit. Sensor research in this area is on-going. Further, if the RI of a fluid placed into the i.d. is higher than that of the Fluoropolymer, a long path length detection cell results; a concept often utilized for Raman Spectroscopy (4).

Table I: Comparison of TSU and TSP capillary properties. %T is transaxial. Values are for 375 μm o.d. capillary.

Property	TSU Series	TSP Series
Fluorescence	Windowed Capillary < TSU	<<<<<< TSP
Refractive Index	1.31	>1.65
Coating Thickness	15 μm	20 μm
Durability	Special handling	Excellent
%T @ 214nm	> 95 %	< 2%

Fluorescence detection within the capillary is often possible due to the low background signal from the Fluoropolymer (5).

Although the coating thickness is similar to that of the TSP series, the TSU capillary is less durable in general and special handling is recommended. Of particular importance is the cleanliness of all work surfaces; a topic discussed previously (6). In some instances, an outer protective coating of Acrylate is added to increase durability.

Conclusion

Fluoropolymer coated synthetic fused silica capillary tubing has been reviewed. This unique UV transparent product is of key importance in a growing number of applications. For assistance with your questions on this product, contact Polymicro.

References

- (1) "The Book on the Technologies of Polymicro," Polymicro Technologies LLC, Ch 3 (2005) pp7-8.
- (2) Teflon®AF is a trademark of DuPont - <http://www2.dupont.com>.
- (3) F. Svec, T.B. Tennikova, and Z. Deyl, Eds., *Monolithic materials: preparation, properties, and applications* (Elsevier, Amsterdam, 2003).
- (4) D. Che and S. Liu, Long (Capillary Waveguide Raman Cell), U.S. Pat. 5,604,587, 1997.
- (5) V. Kostal, M. Zeisbergerova, K. Slais, and V. Kahle, *J. Chromatography* **1081**(1), 36-41 (2005).
- (6) J. Macomber and L. Begay, *LCGC North America Application Notebook*, 63 (June 2003).

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