

POLYIMIDE COATED CAPILLARY TUBING: A STUDY OF WINDOWING TECHNOLOGIES

On-column detection in capillary based chromatographic systems is common in today's analytical laboratory. In most instances, the polyimide coating applied to the fused silica capillary must be removed for optimum detection of analytes. In this application note, we discuss methods for removing the polyimide and compare the resulting strength and optical cleanliness of the detection window.

BY JOE MACOMBER AND KENDRICK WALKER | MOLEX, LLC.

INTRODUCTION

Chromatographic systems that employ polyimide coated fused silica capillary continue to be a staple in the modern laboratory. Many of these systems take advantage of the optical transmission properties of the fused silica, which allows for on-column absorbance detection into the deep UV. Even more common is the use of on-column LIF detection; nowhere is this more prevalent than in Capillary Electrophoresis technologies such as DNA Sequencing. The on-column detection window, which is usually 2 to 6 mm in length, is formed by removing a short segment of polyimide near the outlet end of the capillary column. This process is referred to as windowing and the resulting product is called a windowed capillary (1). Regardless of the detection scheme, there are two fundamental requirements for optimum product performance.

First, the capillary must retain sufficient mechanical strength for routine handling and installation into the system detector. Secondly, and of particular importance in fluorescence applications, is the cleanliness of the window. Any residual polyimide will increase system background noise, and as a result, the decreased S/N will impact detection sensitivity.

In this note a variety of common polyimide removal methods were studied. Tensile strength was determined for each method, as was relative background fluorescence.

EXPERIMENTAL

To eliminate any lot-to-lot variability, all windowed capillary samples were made from the same production lot of TSP050375 (Polymicro, Phoenix, AZ). Windowing techniques studied were UV laser machining (standard production process at Polymicro), a resistively heated hot wire device, Sulfuric acid heated to 130°C (purchased from Fisher, Pittsburgh, PA), a plasma pen (PVA Tepla, Corona, CA), and a butane lighter flame. All windows were 4 to 6 mm in length and located in the center of a 2m long capillary segment. A minimum of 20 samples were made by each technique.

Relative background fluorescence was conducted on a 310 Genetic Analyzer (ABG, Foster City, CA), with a minimum of 5 samples tested from each sample set. Tensile strength measurements were conducted on a minimum of 20 samples from each set using an Instron 3340 (Instron, Norwood, MA). A strain rate of 10"/min was used on all samples, with the gauge length set to 0.5m.

RESULTS

Figure 1 summarizes the data collected in this study, with average values displayed. Error bars are included to demonstrate the relative variance in window strengths. All techniques, if conducted properly, provide sufficiently low fluorescence for most applications. The data suggests that laser machining does the least damage to glass surfaces, producing the strongest windows.

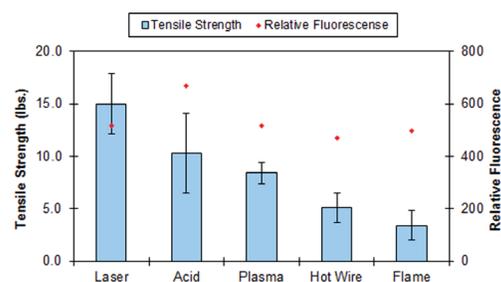


Figure 1: Comparison of windowing techniques.

CONCLUSION

This note compared five techniques used for windowing capillary. Windows formed by laser machining offer the best all-around performance. For assistance with your specific on-column detection application please contact a Polymicro Technical Sales Specialist.

REFERENCES

- (1) "Windowed Capillary," The Book on the Technologies of Polymicro, Polymicro Technologies LLC Publication, p D-14, (2005)