

Bio-medical applications

Refractive index matching in bio-medical research

Water has a very low refractive index that is not attainable by most organic fluids and polymers. In certain microscopic observations, the non-matching of the refractive index of the aqueous medium and the embedding gels or the fixation adhesives creates reflections and optical artifacts.

My Polymers has introduced a series of optically clear low refractive index adhesives designed for encapsulation of tissues, cells and beads which are used in various fields in biological research. The matching RI can be useful in various devices for microscopic studies.

Dr. Kambiz Hamadani of UC Berkeley's Quantitative Biology Institute uses MY-133MC to image the point spread function (PSF) of his confocal microscopy in order to both initially align the optical path and also to periodically check that the multiple excitation and detection volumes of the system are overlapping. When imaging deep into samples which have refractive indices and dispersive properties which are not accounted for by lens manufacturers during the design of the objective lenses typically used in confocal microscopy, chromatic and spherical aberrations can arise and compromise imaging quality. MY-133 uniquely meets the needs of microscopists who wish to know the PSF of their confocal microscope when imaging into aqueous solutions.

Hamadani, K. M. and S. Weiss. Single molecule protein folding kinetics in a co-axial microfluidic mixer. Proceedings of the SPIE- Photonics West. E. Jorg, K. G. Zygmunt, and E. Rainer, editors; 2008; San Jose, CA. SPIE. p 68620A.

Hamadani, K. M. and S. Weiss. 2008. Non-equilibrium Single Molecule Protein Folding in a Co-axial Mixer. Biophys. J. 95:352-365

The low refractive index adhesives are designed to match the refractive index of water and aqueous solution in the range of 1.33-1.34.

Recently, there was some interest in using the MY-133 for Micro-Fluidics applications. The fact that the refractive index closely matches that of water may enable use of the liquid in the micro-channels as the waveguide. Other applications for the extreme low RI is in various bio-sensors, including Surface Plasmon Resonance (SPR) bio-sensors.

The leading material is MY-133 which was originally designed for optical adhesives. This is a UV cured adhesive with an RI of 1.335@589nm in the cured solid state. In addition, for application in which the UV radiation may affect cells or cause the fading out of certain fluorescent dyes, MY Polymers offers a range of moisture cured coatings, most interesting of which is MY-133MC with a refractive index of 1.33. Unlike the UV adhesives, these materials require longer time to cure (time for moisture to diffuse into the coated matrix) on the order of 1-24 hours.

Both UV cured and moisture cured products are 100% solids (namely, with no volatiles), medium viscosity fluids with excellent optical clarity. All the above adhesives are hydrophobic and inert towards the cells and beads. They will not cause dehydration or swelling of the beads.

MY-133 and MY-133MC have a high permeability to oxygen which is amongst the highest found in polymers. It is 2-3 times faster than that of silicones. This property can be utilized in cell growing devices, in micro-fluidic devices and in synthetic membranes. MY-133 was tested by one of our customers and found non-cytotoxic. Based on its inert nature it is expected to be bio-compatible.

Please call or email for more information.



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