HIGH NUMERICAL APERTURE OPTICAL FIBER BUNDLES FOR FLUORESCENCE IMAGING

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Optical fiber bundles (FBs) are powerful imaging tools, providing direct image transmission where each individual fiber core serves as a single imaging pixel. FBs are widely used in fluorescence micro-endoscopic applications due to their flexibility, bending and twisting insensitivity and ability to transfer high-resolution images. However, commercial FBs are manufactured by a limited variety of commercially available glasses, limiting the numerical aperture (NA) values of FBs at around 0.56 [1]. In this study, we fabricated and characterized high-resolution, large NA fiber bundles using high-contrast pairs of in-house synthesized zirconium, sodium and borosilicate soft glasses. We used stack-and-draw technique to fabricate two sets of FBs: Lead-free zirconium-silicate and borosilicate glasses (ZR3/SK222), sodium-silicate and lead-silicate glasses (K209/F2) which reveal the numerical apertures (NAs) of 0.53 and 0.59, respectively [2, 3].

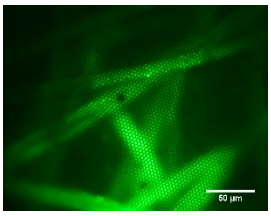

Figure 1: Fluorescence image of paper tissue.

In order to characterize the FBs, we demonstrated transmission imaging of micro-ruler and vascular tissue of *Convallaria majalis*, and fluorescence imaging of fluorescein stained paper tissue and fluorescein isocyanate (FITC) stained cirrhotic mice liver tissue. We obtained good imaging performance for FBs with minimum pixel size and pixel separations values of 1.6 µm and 2.3 µm. Such high NA FBs can enhance the ability of fluorescence signal collecting of fiber based micro-endoscopes.

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