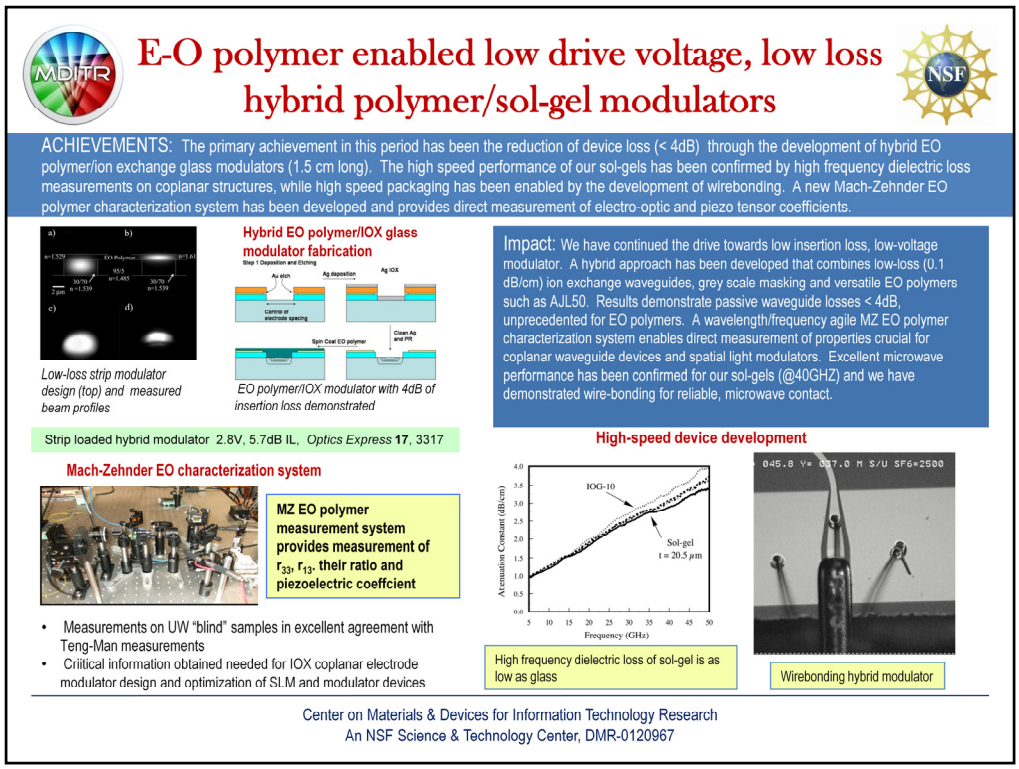

IMPACT: We have continued the drive towards low insertion loss, low-voltage modulator. A hybrid approach has been developed that combines low-loss (0.1 dB/cm) ion exchange waveguides, grey scale masking and versatile EO polymers such as AJL50. Results demonstrate passive waveguide losses < 4dB, unprecedented for EO polymers. A wavelength/frequency agile MZ EO polymer characterization system enables direct measurement of properties crucial for coplanar waveguide devices and spatial light modulators. Excellent microwave performance has been confirmed for our sol-gels (@40GHZ)and we have demonstrated wirebonding for reliable, microwave contact.

DISCUSSION: The full promise of polymer-based EO modulator technology will be realized when devices become available that combine low drive voltage (~ 1V), low insertion loss (~3dB) and ultrahigh bandwidth (40GHz and above) in a single device that can be reproducibly manufactured with high yield and reasonable cost. During this period we initially demonstrated a low-loss (5.7dB), low voltage (2.8V) strip loaded modulator, values which are directly competitive with commercially available lithium niobate modulators. Subsequent efforts have been focused in two directions: (1) demonstrate low microwave loss for both sol-gel and ion exchange glass passive materials as well as robust low-loss microwave contacts and (2) pursue even lower loss modulators by adopting ultra low loss (0.1 dB/cm) ion exchange glass as the passive waveguide medium in a hybrid EO polymer device. As shown above, low microwave loss at 40GHz and above has been verified for sol-gel and ion exchange glass; furthermore, wirebonding has been established as a robust, manufacturable method for making microwave contact. Our efforts on the hybrid EO polymer/ion exchange modulator have demonstrated < 4dB insertion loss for unpoled devices a promising indicator of exceptional modulator performance. We note that at these low levels of insertion loss each additional dB has a 25-30% impact on the figure of merit. In order to enable full optimization of EO polymer materials for coplanar modulators and SLMs, we have developed a wavelength and frequency agile Mach-Zehnder interferometer system for measuring r33, r13, the tensor ratio, and piezoelectric tensor elements as well. This system will also provide important input for hybrid EO polymer/silicon photonics devices, which are highly anticipated and desired for rapidly growing data center networking applications.

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