be explained as follows: 1) The transmittance $\sin^2\delta/2$ has the largest slope near $\delta = \pi/2$, therefore, even a small phase retardation deviation will be magnified. 2) In our VFS cell, the incident angle is quite large (80°). A small residual birefringence from the BPLC sample or depolarization from any optical component could lead to small phase retardation.

Next we removed the QW plate and measured the VT curve of Cell 2 again. As shown in Fig. 3, the transmittance peak occurs at $80V_{rms}$ and the hysteresis [30] (defined as $\Delta V/V_p$, where ΔV is the voltage difference at half-maximum transmittance between forward and backward, and V_p is the peak-transmittance voltage) is quite small (~1%). The dark state of the VFS cell is not very good because of the large incident angle (80°). We used extended Kerr model [31] to fit the VT curve, and obtained Kerr constant $K = -0.16$ nm/V^2. The small Kerr constant is mainly due to the relatively small dielectric anisotropy ($\Delta\varepsilon = -11$) of the host LC.

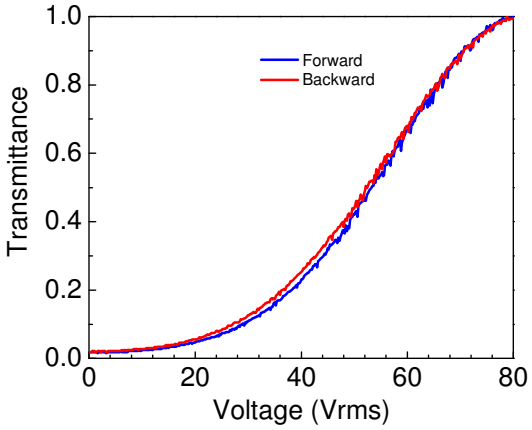

Fig. 3. Measured VT curve of Cell 2 using the experimental setup in Fig. 1(d) without a QW plate in front of the VFS cell.

We also measured the response time (between dark state and peak-transmittance state) of Cell 2 (VFS) at the room temperature. The rise time and decay time are all about 1 ms. As the temperature increases, the response time decreases sharply, which is similar to that of positive $\Delta\varepsilon$ BPLC materials [10].

5. Conclusion

We report the results of a polymer-stabilized BPLC with a negative Kerr constant, which originates from the negative $\Delta\varepsilon$ of the employed LC host. To experimentally prove that indeed the BPLC has a negative induced birefringence ($n_e<n_o$), we incorporated a quarter-wave plate in our measurement system. Our material shows a negligible (~1%) hysteresis and fast response time (~1ms) at the room temperature, although its Kerr constant is ~10X smaller than that of a typical PSBP with a positive LC host, but this value is ~30X higher than that using a DFLC [7]. The flattened refractive index ellipsoid can be used as a tunable C-plate for controlling the viewing angle of a LCD.

Acknowledgments

The authors are indebted to ITRI (Taiwan) for financial support.