Although the crosstalk values in all the channels are higher than those of GI-core waveguides previously evaluated [8], we observe a noticeable trend that the crosstalk values in the SI-core waveguides are 5~10 dB higher than those in the GI-core waveguides, as shown in Table 2. In particular, it is interesting that the launch-condition dependence (SMF or MMF) of the crosstalk is more obvious in the GI-core waveguide. Furthermore, lower crosstalk is observed in high-NA GI-core waveguide (27 wt.% DPS doped), than in the 21 wt.% DPS doped counterpart. These results are attributed to the optical field confinement by the GI-core, as mentioned in section 3.2. As we mentioned in section 3.3, the propagation los of the TPIR-202 based waveguides are currently as low as 0.12 dB at 850-nm wavelength, which is mainly attributed to the excess scattering loss inherent to the TPIR-202 polymer. Hence, such a high scattering loss increases the crosstalk value compared to those in PMMA-based waveguides we previously reported. Therefore, in order to decrease the crosstalk, reduction of the excess scattering loss not only from the core-cladding boundary but inherent to the polymer material would be the key issue. Currently we are theoretically estimating the relationship between the scattering loss and the inter-channel crosstalk in polymer optical waveguides. The preliminary results are described in [18].

**Table 2. Comparison of crosstalk value in GI-core and SI-core waveguides under different launch conditions.**

| Waveguide | Probe | Ch. 1 | Ch. 2 | Ch. 4 | Ch. 5 |
|---|---|---|---|---|---|
| SI Core | SMF | −19.1 dB | −16.3 dB | −12.6 dB | −17.5 dB |
| GI Core | | −32.0 dB | −23.2 dB | −22.3 dB | −29.2 dB |
| SI Core | GI MMF | −17.4 dB | −15.3 dB | −14.8 dB | −16.8 dB |
| GI Core | | −25.9 dB | −20.7 dB | −19.2 dB | −23.7 dB |
| GI Core (27wt.%) | SMF | −40.1 dB | −29.2 dB | −29.8 dB | −41.9 dB |
| | GI MMF | −25.1 dB | −20.5 dB | −20.9 dB | −25.0 dB |

## 4. Conclusion

We succeeded in fabricating a polymer parallel waveguide with GI cores by means of the soft-lithography method. Although the propagation loss of the fabricated waveguide is still as high as 0.1 ~0.3 dB/cm at a wavelength of 850 nm, the waveguides show the unique optical properties of GI-cores, such as optical confinement of propagating mode fields, and low inter-channel crosstalk. In terms of the propagation loss, optimization of the photo initiator concentration for lowering the yellow color led to a remarkable loss decrease even at 850-nm wavelength. Further improvement in the polymer material and photo initiator would make it possible to decrease the loss to less than 0.1 dB/cm.

The polymer optical waveguides with GI cores fabricated on-board directly would be a promising solution for chip-to-chip optical interconnections.

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