Highly polar molecules in a polymer matrix are suitable for second harmonics generation devices since they orient on high voltage poling above $T_g$. Silicon-based donor-acceptor (DA-) compounds have potential since they are transparent in the visible spectrum, and have large dipoles and moderate values of the first hyperpolarizability $\beta$. Our study (synthesis, optical characterization and calculations) focuses on DA-diphenyldisilanes, and their incorporation into polymer. The quantum chemical calculations (semi-empirical and $ab$ initio, finite-field and sum-over-states (SOS)), are compared mutually and with experimental results. The SOS method yields useful predictions for $\beta$. Acceptors containing the sulfonyl group prove to be efficient and retain transparency for the DA-compound. Charge distributions of ground and excited states show that the silicon chain is a charge buffer and a weak transmitter.

Second order non-linear optical effects might lead to novel applications as integrated electro-optic devices. Polymers functionalised with NLO-active groups seem to have good properties for these applications. We have synthesized a polystyrene based NLO-material that can be poled by corona discharge or contact poling to give a very good ordering ($\theta=0.45$). The $r_{33}$ value directly after poling was 12.9 pm/V. The bleachability of the material gives the possibility to make channel waveguides by exposing the material to UV-light through photomasks. Another way to order macroscopic systems is the Langmuir-Blodgett (LB) technique. We have synthesized an amylose derivative with covalently bound NLO-active groups. This material forms stable monolayers.