

New cross-linked polysiloxanes prepared by UV-induced thiol-ene click-reaction

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Abstract

A series of new cross-linked polysiloxane polymers based on functionalized cyclo- and oligosiloxane precursors was prepared by UV-induced hydrothiolation “click”-reaction using DMPA as the initiator and their physico-mechanical properties were studied. The study of a morphology of prepared polymers by scanning electron microscopy (SEM) shows that the microstructure of all samples is homogenous. The mechanical properties of all the samples were studied by the tension and compression tests. It was shown that mechanical properties of studied materials, which significantly depends on precursors nature, can be fine-tuned by changing the structure of the initial vinyl precursor. The Young’s modulus varies in the range of 4.5-117 MPa in the tension test and in the range of 6.3-209 MPa in the compression test. The tensile strength varies in the range of 0.3-3.9 MPa in the tension test and in the range of 2.3-28 MPa in the compression test. The thermal stability of the samples was evaluated by thermal gravimetric analysis (TGA). The weight loss was observed in the range of 275–333 °C in air and 322–370 °C in argon for prepared samples. All samples were characterized by DSC method. It was shown that only DSC curves for polymers **1** and **3** contain transitions related to glass formation (-78 and -35 °C, respectively). All polymer samples have a similar water contact angle in the range of 90-102°.

Keywords

Polysiloxane; monolith; thiol-ene click reaction.

and **3** contain transitions related to glass formation (-78 and -35 °C, respectively). The water contact angle for all polymers is in the range of 90-102°. Further studies of properties such as electrical conductivity, dielectric constants, adhesion to various materials will help determine the area of practical application of new materials. The simplicity and variability of the synthesis in terms of the choice of potential reagents opens up broad prospects for the use of new materials as an alternative to compositions based on hydrosilylation reaction.

Acknowledgment

This work was supported by the Ministry of Science and Higher Education of the Russian Federation (Grant No. 14.W03.31.0018 (Agreement No. 075-15-2021-622)). The synthesis of thiol-containing oligomer and *cis*-tetra[methyl(dimethylvinylsiloxy)]cyclotetrasiloxane was performed with the financial support from the Russian Science Foundation (grant no. 18-73-10152). The obtained compound's characterization was performed with the financial support from Ministry of Science and Higher Education of the Russian Federation using the equipment of Center for molecular composition studies of INEOS RAS. The analysis of water contact angle was made using the equipment of the Collaborative Access Center "Center for Polymer Research" of ISPM RAS.

References

- 1 P. Mazurek, S. Vudayagiri and A. L. Skov, *Chem. Soc. Rev.*, 2019, **48**, 1448–1464.
- 2 G. A. Abakumov, A. V Piskunov, V. K. Cherkasov, I. L. Fedushkin, V. P. Ananikov, D. B. Eremin, E. G. Gordeev, I. P. Beletskaya, A. D. Averin, M. N. Bochkarev, A. A. Trifonov, U. M. Dzhemilev, V. A. D'yakonov, M. P. Egorov, A. N. Vereshchagin, M. A. Syroeshkin, V. V Jouikov, A. M. Muzafarov, A. A. Anisimov, A. V Arzumanyan, Y. N. Kononevich, M. N. Temnikov, O. G. Sinyashin, Y. H. Budnikova, A. R. Burilov, A. A. Karasik, V. F. Mironov, P. A. Storozhenko, G. I. Shcherbakova, B. A. Trofimov, S. V Amosova, N. K. Gusarova, V. A. Potapov, V. B. Shur, V. V Burlakov, V. S. Bogdanov and M. V Andreev, *Russ. Chem. Rev.*, 2018, **87**, 393–507.
- 3 M. Soldatov and H. Liu, *Prog. Polym. Sci.*, 2021, **119**, 101419.
- 4 Q. Ge and H. Liu, *Chem. Eng. J.*, 2022, **428**, 131370.
- 5 E. E. Kim, Y. N. Kononevich, A. A. Anisimov, M. I. Buzin, V. G. Vasil'ev, A. A. Korlyukov, D. S. Ionov, D. A. Khanin, E. V. Shtykova, V. V. Volkov and A. M. Muzafarov, *React. Funct. Polym.*, 2021, **164**, 104896.
- 6 E. E. Kim, Y. N. Kononevich, Y. S. Dyuzhikova, D. S. Ionov, D. A. Khanin, G. G.