Fiber reinforced polymers (FRP) have high specific mechanical characteristics and developed to replace metal constructions. One of the limitations of FRP operation is temperature resistance, which is determined by the polymer matrix. Polymers derived from phthalonitrile resins are known as the most heat resistant polymers (Тg> 400 °C, T5% > 500 °C) among thermosets. However, the use of phthalonitrile resins for production of FRPs requires long curing cycle up to 30 hours including post-curing at 300-375℃. Thus, the existing phthalonitrile resins are suitable for limited composite production techniques and the development of matrices with a short curing cycle for rapid FRPs manufacturing is demanded. In this study fast curing carbon and glass fiber phthalonitrile prepregs for hot-pressing processing were developed.

Phthalonitrile oligomer (PNN) obtained by the reaction of novolac phenolic resin with 4‑nitrophthalonitrile was chosen as an object of this study because of good solubility in low boiling organic solvents. This makes it possible to prepare a highly concentrated solution (>45 weight%) for effective fiber impregnation. Blends of PNN with different mass content of two curing agents 4‑aminophenoxyphthalonitrile (APN) and 1,3-bis(3-aminophenoxy)benzene (APB) based on aromatic amine were prepared. Curing time of resins with different hardeners contents were estimated from the gelation time of the resin at 240°C. Thermal stability of resins was determined by thermal gravimetric analysis (TGA), the T5% (Ar purge) was estimated. The compositions of each amins with the highest T5% (432°C) and the least cure time (6 min) were selected for prepreg fabrication. On the next stage of investigation pressing parameters namely temperature, pressure and holding time were selected. As a result, total time of FRP formation at 240 °C and after 280 °C under 2.1 MPa was 53 minutes. The mechanical tests of the CFRPs and GFRPs were estimated in accordance with international standards.

CFRP with APN: compressive strength 269,6±18,6 MPa; compressive modulus 53,7±4,4 GPa, ILSS 19,8±1,0 MPa.

CFRP with APB: compressive strength 290±44 MPa; compressive modulus 49,2±4,9 GPa; ILSS 26,0±1,0 MPa.

GFRP with APN: compressive strength 544,9±33,3 MPa; compressive modulus 33,8±3,2 GPa, ILSS 69,9±6,2 MPa.

GFRP with APB: compressive strength 389,2±13,5 MPa; compressive modulus 28,0±2,2 GPa; ILSS 48,5±2,3 MPa.