DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

In technology, construction elements are often manufactured by jointing metal or polymer components. Jointing of metal components performed by welding, spotwelding, brazing or gluing steel and aluminum alloys is widely applied. Strength of joints is sufficient to carry relatively large stresses. Jointing of polymers, like welding or gluing, is also widely used in industry. Still unresolved problem concerns processes of jointing polymers with metal components as these materials reveal various diffusion. Some processes of gluing metals and polymers have been developed but they last too long and are inefficient. Hence, scientific research is currently devoted to investigate jointing metal and polymer components by using short operations of injection molding or pressing.
This research is crucial nowadays as it covers very important area of so-called lightweight construction. This type of construction enables to create highly advanced designs such as hulls of modern aircrafts, housing of equipment used for space exploration, lightweight components for automobiles, etc.

In the process of creation of joints of metals and polymers the steel or aluminium alloy element is closed in the injection mold and the liquid polymer is injected into the mold, forming the desired shape of element. The creation of strong joint between metal and polymer takes place in the relatively short time of about 1 s and has the adhesive character. The following factors effect on the strength of such joint:

- Directions and characteristics of flow of liquid polymer in the injection mold. The measurements of flow directions and characteristics of flow will be performed by introduction of micromarkers into the stream of liquid polymer and further microscopic observations,
- Viscosity of the stream of molten polymer. The investigations will be performed by means of rheometers,
- Ways and velocity of polymers crystallization at the interface metal-polymer will be investigated by means of microscopic methods (light polarized and scanning electron microscopy - SEM),
- Faults and cracks at the interface between metal and polymer will be investigated by thermographic methods, making possible obtainment of temperature pictures of joints metal-polymer as well as on the base of holographic methods,
- State of surface of the metal substrate (roughness, oxidation) will be investigated by microscopic and chemical methods.

Performed investigations will make possible the evaluation of discussed factors on the physical mechanism of creation of joint of metal-polymer type characterized by good strength and for improvement of strength properties.

Modeling of individual effects associated with formation of adhesive connections, overall characterization, phenomena occurring during injection of polymer, its crystallization and exploitation of polymer – metal joints, being mathematical generalization, will enable to obtain valuable research.