Graphene, as a flake of pure carbon has focused the afford of the scientists from all over the world including Poland. From the discovery of graphene the study is focused on the potential application of this material in different fields such as electronics/optoelectronics, biomedicine or textile industry. This is possible due to its flexibility, great conductivity, mechanical properties or low toxicity. Another member of two dimensional material (2D) (consisting only of the length and the width) is molibdenium disulphide (MoS_2). Especially, the study on its potential to create polymer based nanocomposites with great thermal conductivity are of huge interest. The relatively low thermal conductivity of MoS_2 limits its further application in this field. To broaden the knowledge on MoS_2, the combination of MoS_2 with a high thermal conductivity materials will be investigated. Here, carbon nanotubes will help to increase the thermal conductivity. Carbon nanotubes (CNTs) exhibit very high thermal conductivity comparable to diamond and higher than graphite and carbon fibers. The outstanding thermal conductivity of CNTs makes them a promising candidate to obtain highly thermally conductive polymer based composites. Their conductivity allows a large potential for improving the properties of existing materials such as, for example. polymer composites. Polymer composites are widely used in many kinds of areas, such as electronic, packaging and labeling, textiles, stationery, plastic parts and reusable containers of various types, laboratory equipment, loudspeakers, automotive components, and polymer banknotes. From the general overview, it appears that very limited conductivity and thermal conductivity is usually characteristic for the polymer composites. Polymers are widely used in all kinds of fields, such as electronics, textiles, auto parts and many others, however, have a very limited thermal conductivity. There are several reasons to increase the thermal conductivity of polymer-based products, for example, using them as heat sinks in the electrical and electronic. It is important to promote the thermal stability and reduce the fire hazards of the polymer nanocomposites. The majority of the polymer end products must pass regulatory fire tests to help assure public safety. Therefore, flame-retardation of polymer is also crucial. Within the project the nanocomposites based on MoS_2 and CNTs and polyolefins will combine both of the advantages of MoS_2 and CNT. MoS_2 will serve as a platform for CNTs growth. It will broaden the knowledge on the fundamental science of these novel molecular hybrids and in the next phase it will open new application in many research areas. Before the nanocomposites formation the project will have a chance to reveal the knowledge on MoS_2 used as a substrate for carbon nanotubes growth via chemical vapor deposition (CVD). It will reveal the influence of the sort of the catalyst, catalyst loading, catalyst size on the final carbon material grown in CVD. The prepared samples will be used for the nanocomposites (based on polyolefins (PP or PE) formation for flame retardancy and thermal conductivity studies. All above-mentioned scientific problems and analysis of the proposed research lead to the following research hypotheses:

(1) 2D MoS_2 will help CNT well dispersing in polymer matrix, which stops CNTs to aggregate, improving the thermal conductivity of the polymer composite.

(2) The MoS_2-CNT/polymer nanomaterials will improve the flame retardancy of polymer materials. The composites will burn at elevated temperature.

Innovative research results that the existing polymeric materials widely used in various types of fields with the combination of MoS_2/CNT will allow the improvement of the flame retardant properties and thermal conductivity.