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MIP: Engineering-2020
Modernization, Innovations, Progress:
Advanced Technologies in Material Science,
Mechanical and Automation Engineering

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# «MIP: Engineering-2020: Modernization, Innovations, Progress: Advanced Technologies in Material Science, Mechanical and Automation Engineering»

## «Peculiarities of choice of materials for pistons of heat engines»

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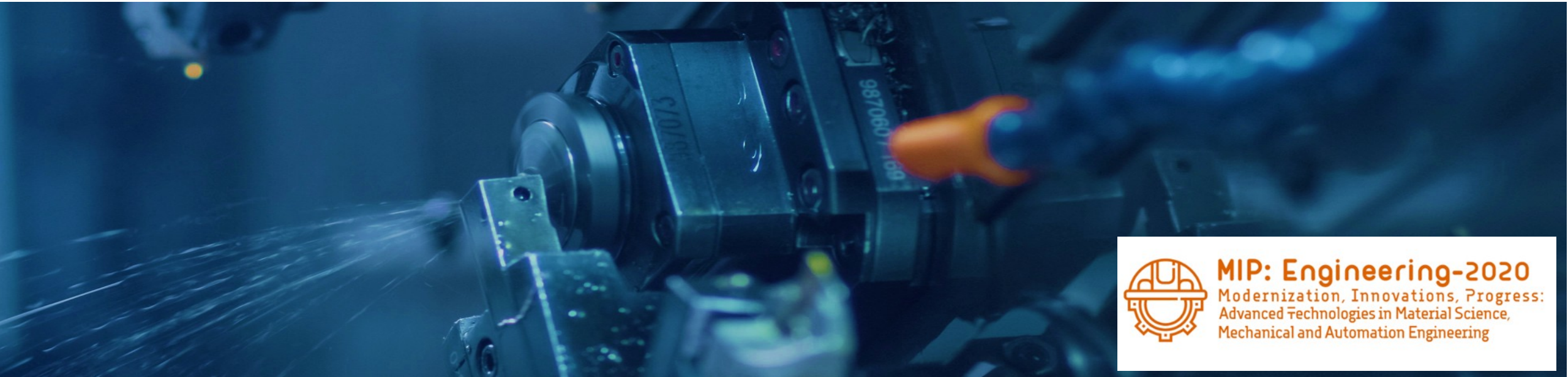
# Problem statement

- A special place is given to working out the design of the piston using the latest computational optimization methods, which will allow you to choose the best material, type of hardening and geometric configuration for a specific type of engine, ensuring compliance with environmental standards and high fuel efficiency.
- For the production of pistons, aluminum alloys, cast iron and steel are used in domestic and international practice.in the past two decades, the development of pistons made of composites has been carried out abroad.
- The main dimensions of the piston are determined based on the properties of materials, static data on the ratio of structural elements of the piston, calculations of its stress-strain state, verified by experimental studies. In this case, special attention is paid to determining the height of the head and the piston itself, the thickness of the bottom and the height of the heat belt

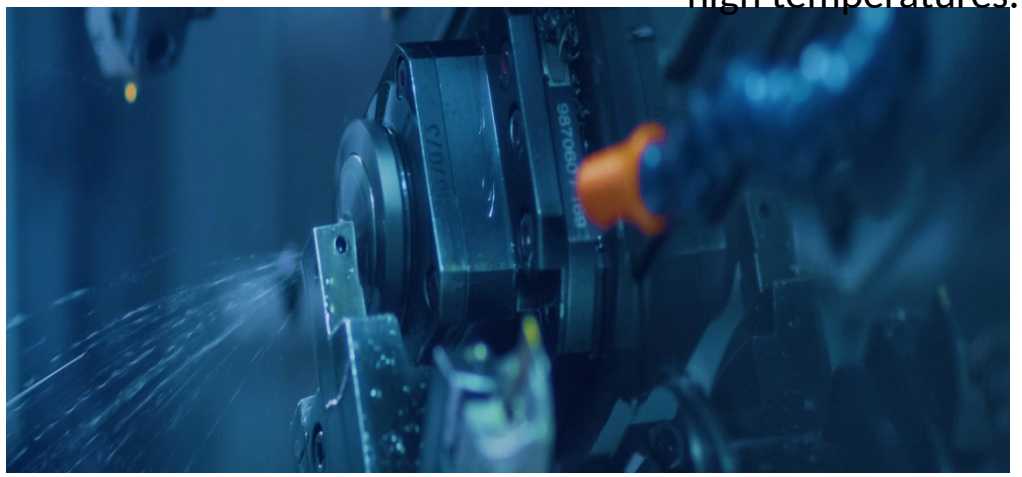


# Solution methods

- It should be noted that the capabilities of traditional piston alloys no longer satisfy the manufacturers of internal combustion engines, who have focused their efforts on increasing wear resistance, thermal and mechanical strength, reducing friction losses, and reducing the weight of the piston.
- Thus, to reduce the wear of the first compression ring groove, special inserts made of cast iron and other materials are used that reduce wear in the friction pair: the piston - compression ring.

**Figure 1.** Composite piston made of aluminum and steel.

Pistons made of aluminum alloys doped with silicon, with a content of the latter 11...13 % (eutectic alloys) and 17...23 % (non-eutectic alloys), are widely used. The main advantages of aluminum alloys over other metals are: low material density, high thermal conductivity and satisfactory tribological characteristics. At the same time, the obvious disadvantages of pistons made from aluminum alloys developed by the industry, such as a significant reduction in strength characteristics at high temperatures.



These include the development of special alloys with the addition of components that improve strength characteristics at high temperatures and reduce thermal expansion, as well as the use of special technologies for manufacturing piston blanks: injection molding, isothermal stamping for eutectic alloys and isothermal stamping for non-eutectic alloys, including granular.

# Conclusions

## Results, implementation

Currently, cast composite materials of the Al-Si/SiC system are increasingly used in the automotive industry.they are characterized by increased wear resistance, high resistance to cracking, a lower coefficient of thermal expansion, improved strength indicators, and heat resistance. The increasing complexity of technology and the corresponding increase in production costs constrain the spread of these materials.

The use of cheap reinforcing elements made of carbon materials instead of expensive ceramic and boron fibers, silicon carbide particles will significantly reduce the cost of composite materials based on aluminum alloys and make them more affordable for mass production.

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