

Analysis of the use of titanium carbide in a gas turbine engine in Ansys Workbench.

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Abstract: the article Investigates commercially used GTE GE J85, the analysis and holding of the last stage of a gas turbine engine static strength. Described and illustrated the basic steps.
Keywords: titanium carbide, the static strength of turbine blades of GTE, Ansys Workbench, the method of additive technologies.

Physical parameters the last stage of the single-loop GTE have a decisive influence on the choice of the material used to manufacture them. For the study of the last stage will replace currently used titanium alloy VT-5 on the titanium carbide TiC.

The new material allows you to use higher loads on the last step of GTE, in connection with higher hardness, strength and melting point that will allow for smaller size of the engine to withstand higher loads.

For the study we choose a widely employed and a proven track record, long-time GTE General Electric J85. It is Used as jet civilian and military use.

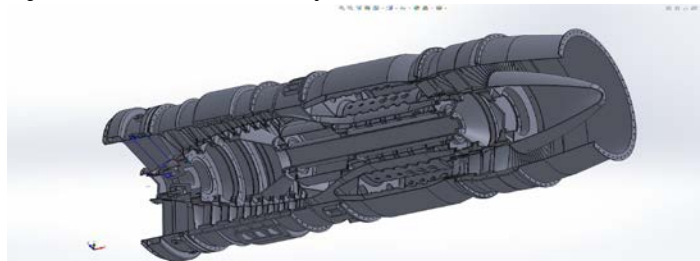


Рис.1. Model GTE General Electric J85

When operating a gas turbine engine rotor blades are static, dynamic and thermal loads. These include the centrifugal force of the mass of the blades, which appear during the rotation of the rotor, and the gas forces arising in the flow gas of the profile pen blades, and in connection with the presence of a difference in gas pressure before and behind the scapula.

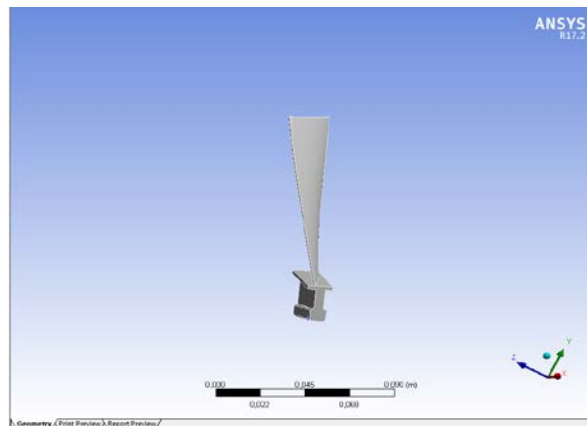


Рис.2. The blade of the last stage of GTE.

When using the software Ansys-Workbench, the process of determining tensile stresses::

The block diagram of the calculation of the tensile stresses (Fig. 3) consists of a single block of Static structural. This unit is loaded the following data:

1. In the "Engineering data", you enter information about the material of the blade (density, elastic modulus, Poisson's ratio, etc.).
2. In the "Geometry" introduces a solid model of the blade, which was built in SolidWorks, and the "Model" is imported in the finite element mesh built in ICEM CFD package;

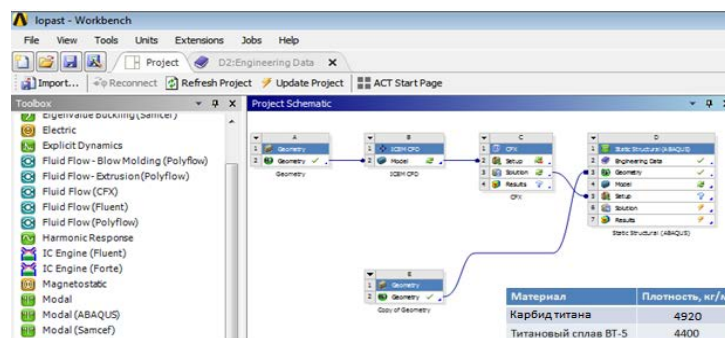


Рис.3. Structural scheme of the calculation model of the blade.

3. "Setup" contains the modal parameters of the task flow and the determination of the stresses: turbulence model, information about the environment of the flow, boundary conditions, convergence criteria, applied force of pressure in the turbine, etc.
4. After entering in all of the above points are computed tensile stresses in the blade (Fig. 4).

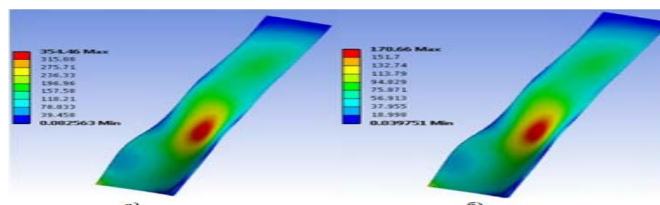


Рис.4 The proportional distribution of tensile stresses at (a) titanium VT-5 and (b) TS.

According to preliminary calculations, the strength and bending moment the use of titanium carbide allows to use them as material for the last stage of TBG, but it was also found that the use of these materials increases the factor of safety at least twice..

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