



## **Forum Inżynierii Materiałowej**

### **Materials Engineering Forum**

- **The Materials Engineering and Metallurgy Committee of the Polish Academy of Sciences**
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## **Carbon in titanium alloys – problems or benefits?**

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Due to unique properties of titanium alloys, they are still considered to be one of the most promising group of materials. Because of the high production costs of titanium alloys, they are preferred material of choice mainly for application in aerospace and military industry. Wide spread applicability of titanium alloys to other applications such as automotive or medicine, requires reduction of total manufacturing cost. One of the basic strategies for reducing the production costs of titanium alloys is to replace expensive alloying elements with cheaper equivalents. Very popular cost-reduction approach is also reduce Al and replace it with O and N.

The presented work concerns the characteristics of microstructure and properties of titanium with higher carbon content. The obtained results can be summarized as follows: carbon, existing in interstitial solid solutions and non-stoichiometric titanium carbides, added to technically pure titanium and titanium alloys in the amount 0.2 wt% (exceeding the current content of 0.08 wt%, but not exceeding the maximum allowable content) results in improvement in their properties by significant increase in strength properties and hardness, increase in Young's modulus, creep, oxidation and abrasive wear resistance, heat treatability by providing the possibility of hardening in combined solution heat treatment and ageing processes and stability of structure at elevated temperature as well as reduction in a susceptibility to grain growth. At the same time, this does not cause the deterioration of ductility, hot formability and corrosion resistance. The negative consequences of the presence of 0.2 wt% of carbon in titanium alloys is deterioration of impact strength (impact energy) and cold formability.

Some presented results are based on the experience from earlier studies conducted in the present Department of Materials Technologies at Faculty of Materials Engineering of Silesian University of Technology, on the possibility of melting the classical titanium alloys and titanium aluminides in vacuum induction furnace with graphite crucibles.