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Investigation of structural changes in Ti-6Al-4V via high energy X-ray diffraction caused by fast cyclical heating

For the planned International Linear Collider (ILC) a material for the positron source is needed, which can withstand the high energy deposition needed for a high luminosity positron source. To distribute the load and keep the target at a reasonable temperature, the target is rotated. Therefore, the material must also withstand the mechanical load during the simultaneous cyclical thermal load. The behaviour of the material Ti-6Al-4V, which is considered as target material, was studied via high energy X-ray diffraction during a cyclical heating process. In this experiment the material was heated homogenously through induction. The influence of the maximum and minimum temperature as well as the cooling rate was researched. Temperatures between 300 °C and 800 °C and cooling rates in the range of 25 °C/s and 100 °C/s were used. The crystal structure of the material mainly depended on the current temperature and the maximum temperature the material reached during the heating process. The lattice parameter of the β phase was here a parameter that correlated to the changes in phase fractions at higher temperatures and gives a reference for new experiments done in 2023 at the Mainzer Microtron, where the material was irradiation via an electron beam to test the impact of irradiation on the material.

Collaboration / Activity

Positron Sources

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