

论文

极化X光谱诊断铝激光等离子体的电子密度

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摘要:

为了准确诊断激光等离子体的电子密度,提出了一种基于极化光谱的类氦共振线与互组合线相对强度比诊断电子密度的方法.该法考虑了激光等离子体发射的X射线存在极化的特性,用极化光谱理论对测量的类氦共振线和互组合线光谱相对强度比进行精密校正,再推导等离子体的电子密度.在 2×10 J激光装置上进行了实验,使用极化PET(OO2)晶体谱仪测量了Al类氦离子光谱,利用光谱的极化特性推出Al等离子体的电子密度约为 $1.5 \times 10^{20} \text{ cm}^{-3}$.结果表明极化X光谱推导等离子体电子密度方法适合激光高温高密等离子体诊断.

关键词: 电子密度 极化晶体光谱仪 X射线光谱 激光等离子体诊断

Diagnosis of Electron Density by Polarized X-ray Lines for Al Laser-produced Plasmas

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Abstract:

In order to accurately diagnose the electron density of laser-produced plasma,the method of relative intensity ratio of helium-like resonance to combination lines was proposed based on the polarization spectrum.It took into account polarization characteristics of the X-ray in laser-produced plasma,modified the real intensity ratios of the resonance to intercombination lines of He-like ions,then derivated the density of plasma.The experiment was carried out at the 2×10 J laser facility at Laser Fusion Research Center of,China Academy of Engineering Physics (CAEP).X-ray spectra emitted from the aluminum plasmas were recorded by polarized PET(OO2) crystal spectrometer.By correcting two Al helium-like spectra,it was calculated that the electron density was about $1.5 \times 10^{20} \text{ cm}^{-3}$.The experimental results showed that the arithmetic was adapted to diagnose laser-produced high temperature high-density plasmas.

Keywords: Electron density Polarized crystal spectrometer X-ray diagnosis Laser-produced plasma

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