

球形光声腔中二氧化碳的检测

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摘要:

气体光声光谱技术是一种基于光声效应的微量气体检测技术,它具有高灵敏度、高选择性、大动态检测范围的优点,本文从理论上讨论了气体检测球形光声腔共振模式的声学特性,计算表明,与常用的圆柱形光声腔比较,球形光声腔不存在粘滞损耗,具有更好的检测特性;利用球形光声腔和二氧化碳激光器构成的气体光声检测系统,从实验上测量了球形光声腔的共振模式,与理论计算结果一致;实验结果表明注入浓度为300ppm二氧化碳的球形光声腔所激发的光声信号为5.68mv,信噪比高达45,尽可能地降低了声波在光声腔内壁附近的热损耗和粘滞损耗,提高了二氧化碳气体检测灵敏度。

关键词: 光声光谱; 球形光声池; 气体检测; 激光技术

Detection of CO₂ in the Spherical Photoacoustic Cell

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Abstract:

photoacoustic spectroscopy is a trace gas detection technology based on photoacoustic effect. It has advantages of high sensitivity, high selectivity and large dynamic range. This paper discusses the theoretical acoustic characters of a spherical photoacoustic cell, the calculation shows that the spherical cell has less viscous loss and better detection characteristics compared to the commonly used cylinder shape cell; the acoustic characters of a spherical photoacoustic cell was tested in the detection system composed by the spherical photoacoustic cell and carbon dioxide laser, results show that the experiment is consistent with the theoretic, and that the photoacoustic signal generated by the 300ppm carbon dioxide in the spherical cell is 5.68mv and high signal-to-noise (S/N) values (~ 45:1). This cell can reduce the heat loss and viscous loss near its wall as much as possible to improve the carbon dioxide detecting sensitivity.

Keywords: photoacoustic spectroscopy, spherical photoacoustic cell, gas detetion, laser technology

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