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燕麦秸秆燃烧灰中矿物质分布及沉积行为

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Characteristics of mineral distribution and deposition behavior in the ash of oat straw combustion

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摘要 在自行设计的沉降炉内研究了燕麦秸秆燃烧灰中矿物质分布及沉积行为。采用X射线衍射(XRD)、扫描电镜能谱(SEM/EDS)及电子探针X射线显微(EPMA)对850℃下不同燃烧时间的沉积物进行分析,并结合化学热力学平衡计算,结果表明,燕麦秸秆燃烧的沉积物形成是碱金属挥发黏结作用使大小不同的燃料球团形成,内部伴随着氧化反应从而形成表面孔洞。钾长石是沉积物形成中起黏结和支撑作用的"骨架"的主要组成部分,在燕麦秸秆燃烧初始沉积中有重要作用。K、Al的分布密集而广泛,Na在一定程度上会促进K的活性,表面的部分碱金属逐渐挥发至气相,Fe、Ca、Mg等的相关化合物不断填充沉积物孔隙使其致密、硬化,最终各元素较均匀地分配。

关键词: 生物质 燃烧 沉积物 碱金属 化学热力学平衡计算

Abstract: The effects of combustion time on the characteristics of mineral distribution and deposition behavior were carried out in a self-designed drop-tube furnace during oat straw combustion. The thermodynamic equilibrium calculations were used to predict the results. Meanwhile, the ashes of different combustion time at 850℃ were analyzed by XRD, SEM/EDS and EPMA. The results show that the initiative formations of oat straw deposition are alkali metal species which can cohere with fuels, then form particles with different sizes. Holes can be formed in these particles surface by internal oxidation reaction. It is found that potassium feldspar is the main species which acts as an important role in cementing action and supporting structure. There are many K and Al species enriched in the initial deposition. In addition, Na can promote the activity of K in some degree. Some K and Na species in the deposition volatilizes into the gas-phase gradually as the combustion time extends. The relevant compounds of Fe, Ca and Mg continue to fill the interspaces and make the structure closed-grain further. Finally, most elements are distributed uniformity in the deposition.

Key words: biomass combustion deposition alkali metals thermodynamic equilibrium calculations

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