

材料科学与工程

石英砂热形态和表面微观结构

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摘要 使用由德国生产的LEIAZ-II A型高温热显微镜对异密度循环流化床床料——石英砂在加热过程中所表现出的熔融特性和热膨胀特性进行了研究。高纯度石英砂在升温过程(室温~1600℃)中存在3个相对独立的特征温度区间: 缓慢膨胀区(室温~870℃), 在此区间试样尺寸变化比较均匀, 线膨胀速率k比较小; 膨胀停滞区(1000~1350℃)内, 试样的体积和形状几乎不随温度的升高而改变, k在此区间近于零; 快速膨胀区(1400~1550℃)内, k在此区间突然增大, 形成一个陡峭的波峰。升温过程中高纯度石英砂试样的膨胀特性与其多晶型转变温度有对应关系。通过不同纯度两个试样的对比实验发现, 纯度直接影响石英砂的熔融特性, 纯度高, 则相应的特征温度值高。利用HITACHI S2150型扫描电子显微镜(SEM)对加热到不同终端温度并冷却到室温的高纯度石英砂颗粒亚稳相的微米级表面结构进行观察, 当终端温度进入快速膨胀区后, 试样由于剧烈的膨胀在表面和内部产生大量微观裂纹, 大量微观裂纹的存在导致试样的力学性能急剧下降, 表现为弹性能力的消失。

关键词 [石英砂; 熔融特性; 热膨胀; 异密度循环流化床](#)

分类号

Thermal behavior and surface microstructure of quartzite particles

Abstract

The melting characteristics and thermal expansion behavior of quartzite particles during heated-up were studied by using a thermal microscope (LEIAZ-II) made in Germany. The results showed that the linear expansion rate of high purity quartzite had three different regions at different temperatures, namely, slow-expansion region (room temperature—870℃), halted expansion region (1000—1350℃) in which the linear expansion rate tended to be zero, and fast-expansion region (1400—1550℃) with a sharp wave crest, respectively. These regions were corresponding to the isomer conversion of SiO₂. The comparison between two samples with different purities showed that the purity of quartzite particle had a remarkably influence on its melting characteristics. A particle with higher purity tended to have a higher characteristic temperature of melting characteristics. Furthermore, the surface microstructure of the high purity quartzite particles heated at different terminal temperatures was also observed by using a scanning electron microscope (HITACHI) S2150. Numerous micro-cracks (about ten microns) would be formed on the surface of the sample when the terminal temperature reached the fast expansion region, and the structure inner the sample was very loosen with numerous of minor-cracks (about one micron in width). These minor-cracks lead to the lose of elasticity and worsened mechanical properties of samples.

Key words [quartzite particles](#) [melting characteristics](#) [thermal expansion behavior](#) [differential circulating fluidized bed](#)

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