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山西典型无烟煤灰流动性的调控

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Adjustment in high temperature flow property of ash from Shanxi typical anthracite

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摘要 为满足气化炉液态排渣的要求,考察和比较了CaO、MgO和Fe_2O_3三种助熔剂对山西典型无烟煤煤灰流动性(熔融性和黏温特性)的影响.研究发现,MgO对硅铝比在1.2~2.0的高硅铝煤灰的流动温度降低最有效,其次为CaO和Fe_2O_3,这是由于使用各种助熔剂时生成不同的高温稳定矿物组分造成的.针对三种助熔剂建立了流动温度和完全液相温度的关系式,并得到了CaO和Fe_2O_3含量与流动温度的关系:FT = 1 593-9.573 × w_{CaO} (R^2=0.9429) 和FT =1 576-8.330 6 × $w_{Fe_2O_3}$ (R^2=0.955 9),可以用于指导助熔剂的添加.CaO无论从降低黏度数值或降低临界黏度温度都具有最好的效果.Ca^{2+}、Mg^{2+}、Fe^{2+}的电负性差异和高温下的产物不同是三种助剂对黏度数值影响不同的根本原因; Mg^{2+}、Fe^{2+}具有较小的离子半径以及单质铁在高温下析出是导致临界黏度温度较高的原因.

关键词: 山西典型无烟煤 高硅铝 熔融性 黏温特性 助熔剂

Abstract: To meet the requirement of gasification of Shanxi anthracites with slag tapping, the effects of CaO, MgO and Fe_2O_3 flux on the improvement of ash fusibility and viscosity-temperature property were evaluated and compared. The results show that for high silicon and aluminum coal ash with the Si/Al ratio from 1.2 to 2.0, the order of fluxing effect is MgO > CaO > Fe_2O_3. The difference of fluxing effect is caused by the different stable minerals formed at high temperature. For three different fluxes, the relation between the flow temperature (FT) and the liquidus temperature (t_{liq}) is determined. And a linear relationship between CaO or Fe_2O_3 content and FT is obtained as follows: FT= 1 593-9.573 × w_{CaO} (R^2=0.942 9) and FT = 1 576-8.330 6 × $w_{Fe_2O_3}$ (R^2=0.955 9), which are useful to guide the addition of flux. CaO, MgO and Fe_2O_3 show different effects on the viscosity-temperature character. Judging from the viscosity value and the temperature of critical viscosity, CaO displays the best performance as a flux. The different electronegativity of Ca^{2+}, Mg^{2+}, Fe^{2+} and the formation of different minerals with addition of CaO, MgO and Fe_2O_3 at high temperature are responsible for the various influences of flux on the viscosity value. Small ion radius of Mg^{2+} and Fe^{2+} and the possible crystallization of iron at high temperature are the reasons for the higher temperature of critical viscosity.

Key words: Shanxi typical anthracite high silicon and aluminum ash fusibility viscosity temperature character flux

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