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油页岩热破裂规律显微CT实验研究

康志勤,赵阳升,孟巧荣,杨栋,邵保平

太原理工大学采矿工艺研究所，太原 030024

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摘要 利用太原理工大学和中国工程物理研究院应用电子学研究所最新共同研制的μCT225kVFCB型高精度（μm级）CT试验分析系统，对油页岩从常温到600 ℃高温下的热破裂过程进行了显微观测和分析，揭示了抚顺油页岩的热破裂阈值温度为300 ℃附近.当温度低于300 ℃时，已可见到极少数较小的微裂隙出现，裂隙多发育于原生层理面以及硬质矿物颗粒的周围，形成的破裂面基本上都与层理面互相平行.当温度超过300 ℃，由于受到热分解化学反应的控制，裂隙的数量、长度和宽度剧烈增加，呈现广泛发育、集中爆发的特点，并使原有裂隙迅速延展和贯通，且裂隙面仍具有与层理面平行的特点，这是油页岩热破裂的典型特征；同时，也形成了许许多多垂直于层理方向的微小裂隙，小裂隙与大裂隙的搭接连通，形成了一个庞大的连通网络结构，从根本上提高了油页岩的渗流能力.

关键词 油页岩 热破裂 显微CT 裂隙 阈值温度 实验研究

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Micro-CT experimental research of oil shale thermal cracking laws

KANG Zhi-Qin, ZHAO Yang-Sheng, MENG Qiao-Rong, YANG Dong, XI Bao-Ping

Mining Technology Institute, Taiyuan University of Technology, Taiyuan 030024,China

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Abstract Utilizing the μCT225kVFCB micro-CT experimental system (μm grade), which was newly co-designed by Taiyuan University of Technology and Applied Electronics Institute, Academy of Engineering Physics of China, a series of triaxial microscopic observation and analysis of oil shale thermal cracking under temperatures from 20 ℃ to 600 ℃ were carried out, It was demonstrated that the thermal cracking temperature threshold is 300 ℃ for the Fushun oil shale. Under 300 ℃, it was observed that a small quantity of micro-fissures formed in the specimen mainly along the raw original bedding and the border of hard mineral particles, the thermal fissure surfaces were basically parallel to the original bedding. After temperature exceeded 300 ℃, due to the influence of chemical reaction of the oil shale pyrolysis, the quantity, length, and width of the fissures increased rapidly, exhibiting the characteristics of widespread and bursting occurrence, original fissures developed and even connected to form larger fissures, and basically all fissure surfaces were still parallel with the surface of original bedding, this is a typical characteristic of oil shale thermal cracking. At the same time, a lot of micro-fissures formed perpendicular to the bedding direction, causing the connection between small fissures and large fissures, resulting in a huge connected network structure, which fundamentally improved the influent ability of the oil shale.

Key words Oil shale; Thermal cracking; Micro-CT; Fissure; Threshold temperature; Experimental research

通讯作者:
康志勤 kangzhiqin810101@126.com
作者个人主页: 康志勤;赵阳升;孟巧荣;杨栋;邵保平