2019년도 제1학기

학위논문 연구계획서

(학과 보관용)

연구계획서 제출자	과 정	석사	학 과	지구천문대기학부(지구	학 기	5	
	학 번	2017311266		성 명	박종길	(인)	
논문 지도 교수	학과·직위			성 명		(인)	
연구 착수 예정일	2017년03월01일		연구 완료 예정일	2019년06월30일			
연구 제목	국 문	지질학적 균열에서 CO2와 H2O 유동(단상 및 다상계)의 질식현상 분석					
	영 문	Characterization of Choked Conditions under Single- and Multi-Phase Transport in Geological Fracture					

In geologic media, fluids exist in various phases (gas, liquid, and supercritical phases), generating multi-phase and multi-component systems. As fluids migrating through geologic fractures reach the sound speed, choked flow can be developed in micro-fractures. To elucidate such choked flow in micro-fractures, thermodynamic analysis and numerical simulations were conducted with CO2, H2O, and CO2-H2O mixtures at various phases ranging from supercritical to gaseous CO2 and liquid H2O. Compressible CO2, with a relatively low speed of sound (~225 m/s at 31.1℃ and 7.38 MPa), demonstrated significant changes in thermodynamic properties with small pressure and temperature variations. In contrast H2O, having a relatively high speed of sound (1,524 m/s), showed little thermodynamic variation. For CO2-H2O mixtures, a small addition of CO2 (or H2O) dramatically reduced the speed of sound from those for pure H2O or CO2. For an idealized converging?diverging micro-fracture with CO2 flow, choked flow and a shock-wave were generated as outlet pressure was decreased to less than 6.8 MPa. The H2O flow did not generate choked flow regardless of any outlet pressures. For CO2-H2O mixtures, choked flow was generated when the CO2 void fraction was greater than 0.7 with an outlet pressure of 6.5 MPa, indicating that presence of H2O inhibited occurrence of choked flow. Finally, potential occurrences of both choked flow and shock-waves were discussed in various geologic environments including geologic CO2 sequestration, geothermal energy development, geysers, and volcano eruptions.

주임교수 귀하

(부족시 별지사용)