論文 / 著書情報
Article / Book Information

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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

（博士課程）
Doctoral Program

論 文 要 旨

THESIS SUMMARY

系・コース： Department of, Graduate major in	Mechanical Engineering 系 コース	申請学位（専攻分野）： Academic Degree Requested	博士 (Engineering) Doctor of
学生氏名： Student's Name	Anindityo PATMONOAJI	指導教員（主）： Academic Supervisor(main)	Tetsuya SUEKANE
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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

Chapter 1 outlines the modeling of the mass transport phenomenon in porous media in groundwater contamination and remediation and geological carbon sequestration, which is the background of this research. It is pointed out that the mass transfer coefficient and the specific surface area cannot be quantified independently due to limitation in visualization technology. As a result, most of existing works are only a phenomenological description. Based on this, the purpose of this research is to construct a new mass transport model in the porous body evaluated by using the X-ray CT.

In Chapter 2, the characterization of porous media was conduction. Algorithms to detect pores and throats from microtomography images were applied. By using the methods, the relationship between the shape of grain particles, porosity, pore size distribution and throat size distribution were evaluated.

In Chapter 3, immiscible fluid displacement in porous media were investigated. Two most likely displacement patterns are viscous fingering and capillary fingering. By using X-ray CT and image processing, the structural characteristics of both displacement patterns were investigated.

In Chapter 4, capillary trapping characteristics under various porous media were evaluated. The amount of trapping, the distribution of trapped clusters, and the morphology of trapped clusters were investigated. At the end, the morphological model of trapped clusters were developed based on the surface area and volume of trapped clusters.

In Chapter 5, dissolution mass transfer process in various porous media was investigated. The model to estimate specific interfacial area of the trapped phase was also developed based on the particle size and amount of trapped gas. For the dissolution mass transfer process, the mass transfer coefficient was divided into two groups: low value and high value depending on the existence of a bypassing phenomenon. This bypassing phenomenon develops due to instability called as dissolution fingering.

Chapter 6 demonstrates the effect of dissolution ratio, which is the ratio of trapped phase solubility to density, to dissolution mass transfer. CO_2, which is a gas with high dissolution ratio, dissolves in two stages, whereas O_2, N_2, and Ar dissolve in only a single stage. As a hypothesis, high dissolution ratio results in a rapid dissolution process, generating high solute concentration around the trapped clusters. As a result, the dissolution process is bogged down, resulting in two stages dissolution and lower mass transfer coefficient about one magnitude lower.

In Chapter 7, the mass transfer model based on non-dimensional number of Sherwood number, Reynolds number, and Schmidt number were developed. Sherwood number represents the mass transfer coefficient. Reynolds number and Schmidt number represent the fluid velocity and trapped gas properties. Given these properties, the dissolution mass transfer model in porous media was successfully generated. The model can be used for various particle size, fluid velocity, and trapped gas properties.

In Chapter 8, a summary and future research prospect were given. In summary, this dissertation independently analyzes the mass transport coefficient and specific surface area separately by the pore-scale visualization method. As a result, the pore scale phenomenon of dissolved mass transport in porous media was successfully observed, which an important contribution in this field. Eventually, both specific interfacial area model and mass transfer coefficient model were also successfully developed, which can be used in industrial applications.

備考 ： 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。
Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).