可互溶流體質量傳遞與流場分析之數值模擬

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摘 要

本文研究數值模擬流經一非均勻隨機分佈孔隙率之多孔性界質之流場分析及其壓力損失，並對其控制參數如平均孔隙率之大小、孔隙率分佈特性之相關長度及平方差、多孔性界質之慣性效應， 對流場之影響做一系統式之分析。結果顯示，多孔性界質之平均孔隙率之大小對有效進入多孔性界質內之流量有顯著之影響。而孔隙率分佈之特性則對有效流量產生不同之效應，特徵相關長度之差 異並未對有效流量有顯著影響，相對的，分佈平方差則影響較為顯著。至於慣性效應之影響，則於工業實用範圍內之數值進行模擬，其影響有效流量之效果亦不顯著。 在毛細管中可互溶流體的置換情況上，預先濕潤之薄層存在對注入毛細管的推斥置換流體之指狀物前緣速度的影響，可利用軸對稱之stokes模擬方式分析。在預先濕潤之薄層的設定上，其黏滯度與注入毛細管的推斥置換流體相同，但卻較毛細管內固有的流體黏滯度低。注入毛細管的推斥置換流體之指狀物以半穩態形式持續推斥管內固有的流體，且其前緣速度在相同體積的Poiseuille flow中心線速度之下。此現象與先前無預先濕潤之薄層存在時相較下，可發現預先濕潤之薄層所產生之潤滑影響。且是在注入之推斥置換流體推斥如同固體之管內固有流體時最明顯。

關鍵詞 : 數值模擬,非均勻多孔性材質，相關長度，有效流量，預先濕潤之薄層

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