「校際傑出學術論文授權暨發表會」

論文摘要表

研究生(中文姓名)	陳毓良
研究生(英文姓名)	YU-LIANG CHEN
論文名稱	利用玻璃球自組裝法製作具三維不規則微結構陣列之滾筒模仁
英文論文名稱	Fabrication of a Roller Mold with 3D Random Microstructures Array by Using Self-Assembly of Glass Beads
指導教授	莊承鑫
指導教授(英文姓名)	Cheng-Hsin Chuang
學位類別	博士
校院名稱	南台科技大學
系所名稱	機電科技研究所
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外文關鍵詞 *self-assembly; roll-to-roll process; 3D random microstructure array; roller mold*	

中文摘要

滾印製程能被用於微陣列結構的大量生產。而在整個製程中扮演重要角色的是滾筒模仁上的微陣列結構製作。本文提出一種製作亂數微圓球陣列結構的方法，此方法藉由自組裝玻璃球達成。製程上使用直徑 74-88 μm 的微玻璃球，首先將微玻璃球與 UV 膠液做混合，再利用我們自行製作的自組裝系統將 UV 膠混合液塗佈在金屬滾筒的表面製作出微陣列結構。由實驗結果得知，自組裝層的堆積密度可由混合液的體積百分比與拉伸速度的控制獲得。結果，在拉伸速度 0.9 mm/min、混合液體積百分比 49%可獲得堆積密度 80%的自組裝層。如今，我們已經呈現出滾筒模仁的一種新的製作方式，此滾筒在 UV 滾印系統上，可用以生產複合光學膜。並且，我們的研究可以達成低成本無接縫滾筒的製作,相對於傳統的滾筒模仁製作,如：雷射加工、光微影技術、鑽石切削…等。

英文摘要

A roll-to-roll process may be used as mass production technology in microstructure arrays. To do so, it is important to fabricate the roller mold with a microstructure array profile. This paper proposes a method for fabricating a roller mold coated with a random, spherical microstructure array layer through the self-assembly of glass beads. The glass beads, ranging from 74-88 μm in diameter, were first mixed with a UV-curable adhesive before being assembled on a steel roller by a home-made dip coater with a UV curing system. The experimental results indicate that both the number of

self-assembly layers and the filling ratio depend on both the draw rate and the concentration of glass beads. As a result, the self-assembled layer of glass beads on the roller with a high filling ratio of about 80% was performed at a coating speed of 0.9 mm/min and with a 49% volume ratio of beads. Currently, we have introduced the roller mold to manufacture complex optical films using a roll-to-roll UV system; therefore, our present study could provide a low-cost means to fabricate a seamless steel roller with a 3D random microstructure array, instead of other expensive processes such as laser machining, photolithography, etching or diamond tuning.