平版印刷用鋁板電解粗化之研究

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摘 要

本研究針對平版印刷用鋁板進行粗化製程，並藉由蝕孔形貌 與微結構觀察以及表面性質分析，來了解鋁板經粗化之蝕孔衍生 成長機構與差異。實驗中採用正弦波與方形波兩種交流電源波形 以及使用硝酸系、鹽酸系電解液，並選用不同製程所生產之1050 鋁底材（CC 料與DC 料）。電解操作條件為電流密度15A/dm 2 、 交流頻率50Hz 、電解液溫度35 ℃及30 秒~300 秒系列的粗化時 間，粗化後鋁板浸漬於磷、鉻酸混合液中去除腐蝕膜，藉由量測 表面粗糙度、蝕孔衍生數目與靜電容量進行表面性質分析，並利 用SEM 觀察蝕孔形貌以及複製蝕孔內部結構之複製模，以期瞭 解粗化過程對於蝕孔表面形貌、蝕孔內部衍生構造與表面性質的 關係，實驗中又以TEM 解析含腐蝕膜試片之蝕孔微結構與腐蝕 膜組織結構鑑定，並以EDS 半定量分析來鑑定腐蝕膜之組成。 實驗結果顯示在硝酸液中含腐蝕膜的粗化表面所呈現高度的 包旋表面，在鹽酸液中粗化鋁板則為具有許多坑洞的平坦的表 面。另外由蝕孔橫截面的觀察，硝酸系的蝕孔特徵為半圓形蝕孔， 鹽酸電解液之蝕孔特徵為不規則的半圓形蝕孔，蝕孔寬度較深度 大且底部較為平坦。腐蝕膜組織皆為多孔非晶的氫氧化鋁，在硝酸電解液中腐蝕膜呈現層狀的結構且複製蝕孔曲率，顯示具有陽 極膜的可能，在鹽酸電解液中腐蝕膜內部含有許多小孔洞，腐蝕 膜的形成屬於沈積膜的形式。使用不同粗化電源波形於硝酸液電 解粗化時，發現兩種波形所衍生的蝕孔皆為半圓形蝕孔，方波所 -vii- 衍生的蝕孔較為密集且隨粗化時間的增加，蝕孔發展因集中於包 旋蝕孔，而使得粗化表面的蝕孔發展不如正弦波的發展均勻。由 蝕孔橫截面觀察顯示，方形波所形成的腐蝕膜除層狀腐蝕膜外尚 具有覆蓋形式之沈積膜。方形波的蝕孔朝向不均勻發展主要受方 形波所提供的粗化電量較正弦波多以及腐蝕膜的沈積造成小型蝕 孔被覆蓋，蝕孔的發展轉至包旋蝕孔或大型的圓形蝕孔所造成， 因此粗化電量大，造成蝕孔尺寸發展過大，腐蝕膜的沈積造成蝕 孔發展不均勻。對不同製程條件生產的1050 鋁板粗化行為探討發 現DC 料與CC 料於硝酸電解液粗化時蝕孔的演進過程相近，所生成的基本蝕孔均為圓形蝕孔，並由於圓形蝕孔間的側向連結會 有彎月型蝕孔的特徵，當蝕孔間產生二維方向的連結時則形成包 旋蝕孔。 雖然CC 料與DC 料皆為1050 系印刷用鋁板，但其製 程方式不同，所表現出的粗化性質亦有所差異。DC 料在蝕孔的 發展上演進較慢，使得表面粗糙度及蝕孔數量皆低於CC 料，同 時其表面積增加率較低。 由於平版印刷板擁有較高的印刷品質與強韌的耐印性，因此 廣泛使用於印刷界。平版經由適當的粗化處理可有效地提升印刷 品的解析力與印刷品質，本研究的結果可幫助業者作為日後平版 印刷用鋁板粗化條件的參考與品質提升改善的基礎。

關鍵詞 : 電解粗化 ; 平版印刷板 ; 半圓型蝕孔 ; 方形蝕孔 ; 電蝕 ; 包旋蝕孔 ; 彎月形蝕孔 ; 腐蝕膜

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