

995-7456-2 IPO's COPY



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International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : C25D 3/38	A1	(11) International Publication Number: WO 98/41675 (43) International Publication Date: 24 September 1998 (24.09.98)
(21) International Application Number: PCT/US98/05211 ✓ (22) International Filing Date: 17 March 1998 (17.03.98) ✓ (30) Priority Data: 08/819,061 ✓ 18 March 1997 (18.03.97) ✓ US ✓ (71) Applicant (for all designated States except US): LEARONAL, INC. [US/US]; 272 Buffalo Avenue, Freeport, NY 11520 (US). ✓ (72) Inventor; and (75) Inventor/Applicant (for US only): BRASCH, William, R. ✓ [US/US]; 11 Canterbury Lane, Nesconset, NY 11767 (US). ✓ (74) Agents: FANUCCI, Allan, A. et al.; Pennie & Edmonds LLP, 1155 Avenue of the Americas, New York, NY 10036 (US).	(81) Designated States: CN, JP, KR, (SG) US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>	
(54) Title: CYANIDE-FREE MONOVALENT COPPER ELECTROPLATING SOLUTIONS ✓ (57) Abstract A substantially cyanide-free plating solution for depositing copper from the monovalent ionic state, which includes a source of copper ions, a reducing agent capable of reducing divalent copper ions to monovalent copper ions, an alkali material in an amount sufficient to maintain the pH of the solution in the range of about 7 to about 10, and a complexing agent of an imide, such as succinimide, 3-methyl-3-ethyl succinimide, 3-methyl succinimide, 3-ethyl succinimide, 3,3,4,4-tetramethyl succinimide, or 3,3,4-trimethyl succinimide, or a hydantoin, such as dimethyl hydantoin. The substantially cyanide-free plating solutions may also include at least one of a conductivity salt, an additive to promote brightness, or an alloying metal. The reducing agent may be an alkali sulfite, alkali bisulfite, hydroxylamine, or hydrazine. The copper is typically provided in the form of CuCl, CuCl₂, CuSO₄, or Cu₂O in an amount sufficient to provide a copper ion concentration of from about 2 to about 30 grams per liter of solution, and the complexing agent is present in an amount sufficient to provide a molar ratio of copper ions to complexing agent of from about 1:1 to about 1:5, preferably about 1:4. The alkali material is typically NaOH, KOH, NH₄OH, or Na₂CO₃, and the conductivity salt is typically NaCl, KCl, Na₂SO₄, K₄P₂O₇, Na₃PO₄, C₆H₅Na₃O₇, C₆H₁₁NaO₇, NH₄Cl, or KNaC₄H₄O₆. Useful additives include organic amines or oxyalkyl polyamines, such as triethylene tetramine, tetraethylene pentamine, and polyoxypentyl-triamine. Methods for preparing such a solution for plating copper onto a substrate, and of plating copper onto a substrate with such a solution are also disclosed.		