(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
6 April 2006 (06.04.2006)

PCT

(10) International Publication Number
WO 2006/036505 A1

(51) International Patent Classification:
C08K 3/36 (2006.01) *H01L 23/29* (2006.01)
C08K 9/04 (2006.01) *H01L 21/56* (2006.01)

(21) International Application Number:
PCT/US2005/032119

(22) International Filing Date:
12 September 2005 (12.09.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10/950,691 28 September 2004 (28.09.2004) US

(71) Applicant *(for all designated States except US)*: **INTEL CORPORATION** [US/US]; 2200 Mission College Boulevard, Mailstop SC4-202, Santa Clara, CA 95052-8119 (US).

(72) Inventors: **SHI, Song-Hua**; 4321 East Glenhaven Drive, Phoenix, AZ 85048 (US). **CHEN, Tian-An**; 527 West Desert Flower Lane, Phoenix, AZ 85045 (US). **ZHANG, Jason**; 493 E. Sheffield Avenue, Gilbert, AZ 85296 (US). **CERTEZA, Katrina**; 3601 E. Rocky Slope Dr., Phoenix, AZ 85044 (US).

(74) Agent: **SHICHRUR, Naim**; Pearl Cohen Zedek Latzer, LLP, 10 Rockefeller Plaza, Suite 1001, New York, NY 10020 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) **Title:** UNDERFILL MATERIAL TO REDUCE BALL LIMITING METALLURGY DELAMINATION AND CRACKING POTENTIAL IN SEMICONDUCTOR DEVICES

(57) **Abstract:** An electronic structure includes an electronic device coupled to a substrate by conductive bumps and ball limiting metallurgy (BLM). Underfill material having filler particles is disposed in a space between the electronic device and the substrate. A weight percentage of the filler particles is at least about 60%. A particle size of at least 90wt% of the filler particles is less than about 2μm and/or the filler particles are coated by an organic coupling agent. Once the underfill material is fully cured, its coefficient of thermal expansion is no more than 30PPM/°C, and its glass transition temperature is at least 100°C, and its adhesion to a passivation layer of the electronic device, to the substrate and to the electronic device at its edges is such that the electronic structure passes standardized reliability tests without delamination of the ball limiting metallurgy.

WO 2006/036505 A1