

The following are recommended articles for lead-free solders from an advisory group of TMS subject matter experts



TECHNICAL AREA	PAPER TITLE	AUTHOR(S)	SOURCE	
<b>Alloy Development</b>	<i>Metallurgy of Low Temperature Pb-Free Solder for Electronic Assembly</i>	J. Glazer	International Materials Reviews, vol. 40, no. 2, 1995, pp. 65- 93.	<a href="#">[view abstract]</a>
	<i>Microstructure and Mechanical Properties of Pb-Free Solder Alloys for Low-Cost Electronic Assembly: A Review</i>	J. Glazer	J. Electr. Mater., vol. 23, no. 8, 1994, pp. 693-700.	
	<i>Microstructure and Mechanical Behavior of Novel Rare Earth-Containing Pb-free Solders</i>	M.A. Dudek, R.S. Sidhu, N. Chawla, and M. Renavikar	J. Elec. Mater., vol. 35, 2006, pp. 2088 - 2097.	<a href="#">[view abstract]</a>
	<i>Experimental and Thermodynamic Assessment of Sn-Ag-Cu Solder Alloys</i>	K.-W. Moon, W.J. Boettinger, U.R. Kattner, F.S. Biancaniello, and C.A. Handwerker	J. Elect. Mater., vol. 29, 2000, p. 1122.	<a href="#">[view abstract]</a>
	<i>Microstructure and Mechanical Properties of Lead-free Solder Joints Used in Microelectronic Applications</i>	S.K. Kang, P.A. Lauro, D.-Y. Shih, D.W. Henderson and K.J. Puttlitz	IBM J. Res. & Dev. , vol. 49 (4/5), 2005, p. 607-620.	<a href="#">[view paper]</a>
	<i>Physics and Materials for Lead-free Solders</i>	K.N. Tu, A.M. Gusak, and M. Li	J. Appl. Phys., vol. 93 (3), 2003, pp. 1335-1353.	<a href="#">[view abstract]</a>
	<i>Development of Sn-Ag-Cu and Sn-Ag-Cu-X alloys for Pb-free electronic solder applications</i>	I.E. Anderson	J. Mater. Sci: Mater. Electron, vol. 18:55-76, 2007, pp. 55-76.	<a href="#">[view paper]</a>
<b>Mechanical Properties and Fatigue</b>	<i>Effects of Cooling Rate on Creep Behavior of a Sn-3.5Ag Alloy</i>	F. Ochoa, X. Deng, and N. Chawla	J. Elec. Mater., vol. 33, 2004, pp. 1596-1607.	<a href="#">[view abstract]</a>
	<i>Creep Deformation Behavior of a Sn-3.5Ag Solder/Cu Couple at Small Length Scales</i>	M. Kerr and N. Chawla	Acta Mater., vol. 52, 2004, pp. 4527-4535	<a href="#">[view abstract]</a>
	<i>Deformation Behavior of (Cu, Ag)-Sn Intermetallics by Nanoindentation</i>	X. Deng, N. Chawla, K.K. Chawla, and M. Koopman	Acta Mater., vol. 52, 2004, pp. 4291-4303.	<a href="#">[view abstract]</a>
	<i>Thermomechanical Fatigue Behavior in Sn-Ag Solder Joints</i>	T. S. Choi, K. N. Subramanian, J. P. Lucas	J. Electr. Mater., vol. 29, no. 10, 2000, pp. 1249-57.	<a href="#">[view abstract]</a>
	<i>Interfacial reactions and impact reliability of Sn-Zn solder joints on Cu or electroless Au/Ni(P) bond-pads</i>	M. Date and K.N. Tu	J. Mater. Res., Vol. 19 (10), 2004, pp. 2887-2896.	<a href="#">[view abstract]</a>
	<i>Application of Asymmetrical Four Point Bend Shear Test to Solder Joints</i>	O. Unal, I.E. Anderson, J.L. Harringa, R.L. Terpstra, B.A. Cook and J.C. Foley	J. Electron. Mater., Vol. 30, 2001, pp. 1206-1213.	<a href="#">[view abstract]</a>
<b>Intermetallic Formation</b>	<i>Influence of Initial Morphology and Thickness on Growth and Evolution of Cu<sub>6</sub>Sn<sub>5</sub> and Cu<sub>3</sub>Sn Intermetallics During Thermal Aging of Sn-Ag Solder/Cu Joints</i>	X. Deng, G. Piotrowski, J.J. Williams, and N. Chawla	J. Elect. Mater., vol. 32, 2003, pp. 1403-1413.	<a href="#">[view abstract]</a>
	<i>Intermetallic Growth Behavior of Low and High Melting Temperature Solder Alloys</i>	D. R. Frear and P. T. Vianco	Metall. Trans., vol. 25A, 1994, pp. 1509-1523.	<a href="#">[view abstract]</a>
<b>Tin Whisker Formation</b>	<i>Mechanism and prevention of spontaneous tin whisker growth</i>	K. N. Tu, J. O. Suh, A. T. C. Wu, N. Tamura, and C. H. Tung	Mater. Trans., vol. 46 (11), 2005, pp. 2300-2308.	<a href="#">[view abstract]</a>

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	<i>Whisker and Hillock Formation on Sn, Sn-Cu and Sn-Pb Electrodeposits</i>	W.J. Boettinger, C.E. Johnson, L.A. Bendersky, K.-W. Moon, M.E. Williams, and G.R. Stafford	Acta Mater., Vol. 53, 2005, pp. 5033-5050.	<a href="#">[view abstract]</a>
	<i>Sn-Whiskers: Truths and Myths</i>	J. Osenbach, J. M. DeLucca, B. D. Potteiger, A. Amin, and F. A. Baiocchi	Journal of Materials Science: Materials in Electronics, vol. 18(1-3), 2007, pp. 283-305.	<a href="#">[view paper]</a>
	<i>A History of Tin Whisker Theory: 1946-2004</i>	G. T. Clayton	SMTAI International Conference, September 26-30, 2004	<a href="#">[view paper]</a>
<b>Dissolution of Metals</b>	<i>Cu Substrate Dissolution in Eutectic Sn-Ag Solder and Its Effect on Microstructure</i>	S. Chada, R. A. Fournelle, W. Laub and D. Shangguan	J. Elect. Mater., vol. 29, no. 10, 2000, pp. 1214-1221.	<a href="#">[view abstract]</a>
<b>Mechanical Modeling</b>	<i>Microstructure-Based Modeling of Deformation in Pb-free Solders</i>	N. Chawla and R.S. Sidhu	J. Mater. Sci. – Materials in Electronics, Special Issue on Pb-free Solders, 2007.	<a href="#">[view paper]</a>
	<i>Deformation Analysis of Lap Shear Testing of Solder Joints</i>	Y.-L. Shen, N. Chawla, E.S. Ege, and X. Deng	Acta Mater., vol. 53, 2005, pp. 2633-2642.	<a href="#">[view abstract]</a>
<b>Electromigration</b>	<i>Electromigration in Pb-free SnAg3.8Cu0.7 solder stripes</i>	Y. C. Hsu, C. K. Chou, P. C. Liu, Chih Chen, D. J. Yao, T. Chou, and K. N. Tu,	J, Appl Phys. Vol. 98 (3): Art. No. 033523, 2005	<a href="#">[view abstract]</a>
<b>RoHS Requirements</b>	<i>Uses and Risks of Lead in Products - Summary of Policy Study for the EC</i>	Arnold Tucker	TMS Lead-Free Technology Workshop 2005	<a href="#">[view presentation]</a>
	<i>Impacts of RoHS (e.g., Pb) on Electronic Products</i>	John H. Lau	TMS Lead-Free Technology Workshop 2005	<a href="#">[view presentation]</a>