



Association Connecting Electronics Industries



IPC SOLDER PRODUCTS VALUE COUNCIL LEAD FREE TECHNICAL WHITE PAPER

ANALYTICAL PROCEDURES FOR PORTABLE LEAD-FREE ALLOY TEST DATA

May, 2010





MISSION STATEMENT

In support of IPC's Mission Statement, IPC solder manufacturers recognize that the PCB and electronics assembly industries, comprised of the entire supply chain, must grow profitably. The

Solder Products Value Council Steering Committee's objective is to identify and execute programs designed to enhance the competitive position of solder manufacturers and their customers.

SOLDER PRODUCTS VALUE COUNCIL MEMBERS

AIM	Nihon Superior Company Ltd.
Amtech, Inc.	Nordson EFD LLC
Cookson Electronics	P. Kay Metal Inc.
Henkel Corporation	Qualitek
Heraeus, Inc.	Redring Solder
Indium Corporation	Redring Solder (M) SDN
Inventec Performance Chemicals	Senju Metal Industry
Kester	Shenmao Technology, Inc.
Koki Company Ltd.	Sigma Ming GOA Electronics
Matsumura Metal Co., Ltd.	Yik Shing Tat industrial Co.
Metallic Resources, Inc.	





IPC SOLDER PRODUCTS VALUE COUNCIL LEAD FREE TECHNICAL WHITE PAPER

Analytical Procedures for Portable Lead-Free Alloy Test Data

Introduction

Due to marketing and legislative pressures in Asia and Europe, the electronics industry has moved to adopt lead-free solders. These lead-free materials are considered by some to be environmentally preferable to lead containing solders that dominated electronics manufacturing for many years.

Although the issue as to whether lead-free solders are indeed environmentally preferred compared to lead containing solders is still under debate, market and legislative actions have forced a change in materials used in electronics assembly.

Accordingly, solder material suppliers are being asked to provide the electronics industry with solders that are lead free (per the accepted technical definition of that term) and yet still provide all the needed properties — including ease of assembly and reliability — the electronics industry has come to expect from lead containing solders. Solder suppliers are devoting their efforts to improving their products and offering their customers an ever growing choice of alloys.

However, for OEMs and EMS companies, this proliferation of alloy choices poses a problem. There isn't the wealth of physical data available for these alloys as there is for 63/37 (tin/lead) because of limited time in the market and the limited years of investigation by suppliers, users and academia.

For many of the first lead-free alloys introduced, e.g. SAC 305, while not completely characterized, their reliability properties are better understood than that of the new alloys being introduced — making it difficult to compare alloy properties. So while it is tempting for the electronics assembly industry to look to the new alloys as solutions to the manufacturing issues of the "older" materials, the lack of reliability characterization of these new materials introduces uncertainty when compared to current lead-free solders.

To address this problem, the IPC Solder Products Value Council (IPC SPVC) in cooperation with several leading OEMs and EMS providers has developed a set of test protocols for evaluation of new lead-free alloys on the basis of their physical properties, e.g. creep, and their performance in the assembly of a standardized test vehicle.

This paper will focus on the physical testing of lead-free alloys. The goal of this white paper is to reduce the time and effort required to characterize an alloy and thus help the electronics assembly industry improve its assembly processes without jeopardizing reliability.

Test Subcommittee Members

The work of the SPVC in this study was under the direction of four team members chosen from the SPVC, including Paul Lotosky, Cookson Electronics; Ross Bernstein, Indium; Stan Rothschild, Metallic Resources and Karl Seelig, AIM. Greg Munie of IPC was appointed to be the secretary for the team.

Acknowledgements

This effort could not have been achieved without the support of numerous people in the industry. SPVC would like to specifically acknowledge the efforts of:

Dennis Fritz, MacDermid, Inc.
 Carol Handwerker, Purdue University
 Greg Henshall, Hewlett-Packard Company
 David Hillman, Rockwell Collins
 David Humphrey, Honeywell Engines & Systems
 Christopher Hunt, National Physical Laboratory
 Wayne Johnson, Auburn University
 Stephan Meschter, BAE Systems Platform Solutions
 Jennifer Nguyen, Flextronics International
 Anthony Rafanelli, Raytheon Company
 Dongkai Shangguan, Flextronics International
 Joseph Smetana, Alcatel-Lucent
 Ganesh Subbarayan, Purdue University
 Fred Verdi, ACI/EMPF
 Paul Vianco Sandia, National Labs Albuquerque
 George Wenger, Andrew Corporation
 Thomas Woodrow, Boeing Company
 Linda Woody, Lockheed Martin Missile & Fire Control
 Dongji Xie, Flextronics International

1.0 SCOPE

1.1 Scope This document prescribes general requirements for determining critical physical and mechanical properties of bulk lead-free solder alloys used to make high quality electronic interconnections. This document describes material tests that generate portable data for: (1) direct comparison of different alloys, (2) aiding in alloy acceptability determination for various applications, (3) development of reliability models, and (4) other uses.

1.1.1 Purpose This standard defines the characteristics of solder alloys through the definitions of properties and specification of test methods. These requirements for solder alloys are defined in general terms of material properties. In practice, where more stringent requirements are necessary, additional requirements shall be defined by mutual agreement between the user and supplier. Users are cautioned to perform other tests (beyond the scope of this specification) to fully determine the acceptability of solder alloys for specific purposes.