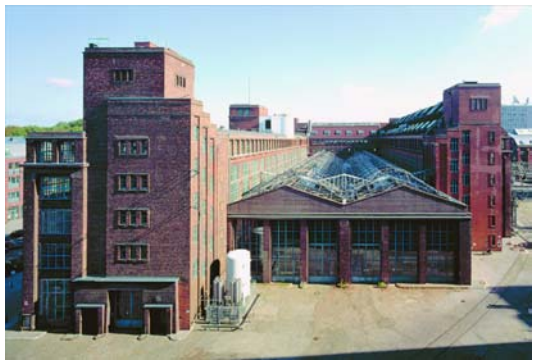
Forschungsschwerpunkt
Technologien der Mikroperipherik



Fraunhofer Institut Zuverlässigkeit und Mikrointegration

Marcel Hagelüken

Data acquisition and quality from the perspective of EE products and processes

Karlsruhe, October 20th, 2003

BeCAP: Berlin Center of Advanced Packaging

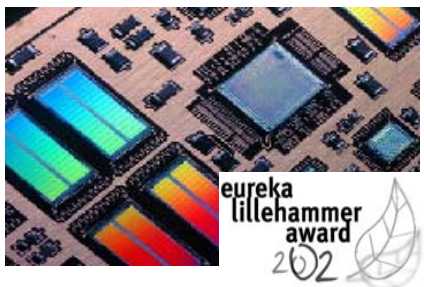
A Center of Competence for Packaging, Reliability,Quality and Sustainability

Director: Prof. Dr.-Ing. Dr. E.h. Herbert Reichl

Green Electronics

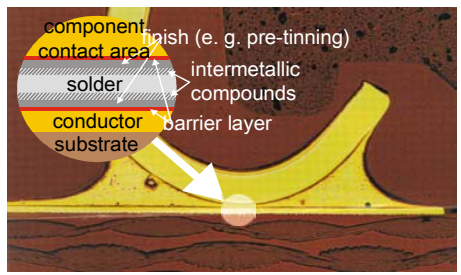
Sustainable Technologies (TUB FSP MP) + Environmental Engineering (FhG IZM)

Research and Development



- EcoDesign: Analysis and environmental assessment
- Translating electronics trends to sustainability terms
- Component ReUse strategies
- Assessment of remaining life-time for maintentance and reuse using life cycle units

Service for the Industry



- Demonstration Center “Product Cycles”
- Micro Material Center Berlin
- Demo-lab for environmental management
- Industrial working group “Lead-free Interconnection Technologies in Electronics”

International Networking

- Electronics Goes Green
- IEEE / CPMT Chair of TC 21 “Green Electronics”
- Co-operation with internat. Institutes in Warsaw, Ljubljana, Universities of Wisconsin/ Madison, California/Irvine, Tokyo and Delft, MIT Delhi
- Educating EcoDesign

Contents

- Introduction
- Problems regarding product data of EE products
- Data quality assessment
- Conclusion

Introduction

Characteristics of Eco-Design in the EE industry:

- short product and process innovation cycles
- complex product composition and assembly
- (very) large supply chains

Eco-Design in the EE industry therefore requires:

- fast product and process data compilation
- easy data management for updates and revisions
- rapid environmental assessment results based on few data

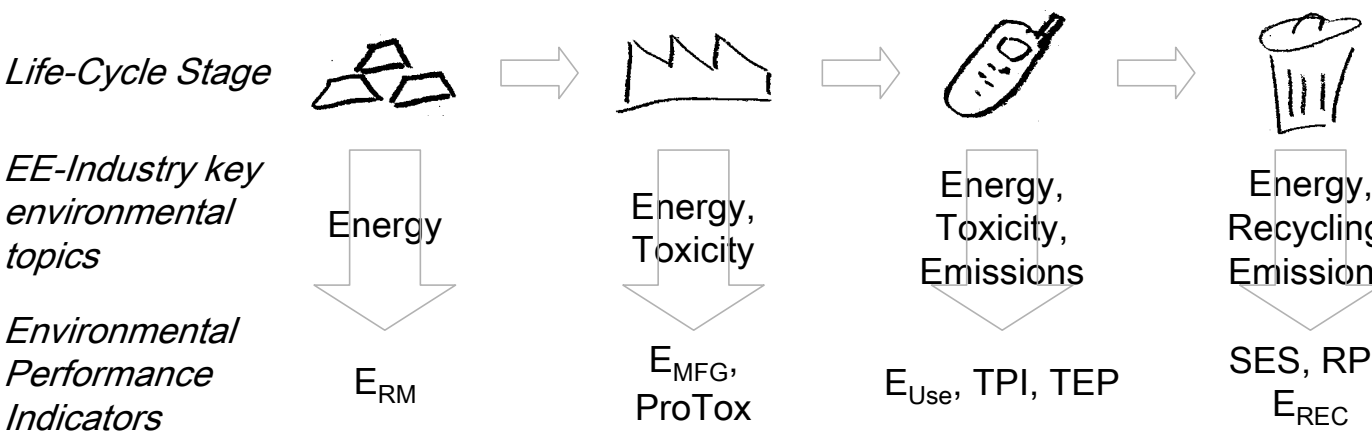
Introduction (2)

Main requirements can be met by

- qualitative or half-quantitative assessment
- "educated guesses"
- generic data-sets
- cut-off criteria
- simplified impact assessment
- specific (internal) environmental performance indicators

Introduction (3): IZM/EE Approach

- iterative screening up to full scale LCA
  (however, the latter is uncommon)
- tailored to suit assessment of early design alternatives as well as redesign processes
- environmental performance indicators based on rather few, easy accessible data



Problems regarding product data of EE products

Creation of product/process data inventories is complicated by

- vast number of components of different manufacturers

Example Ericsson SH 888 GSM Phone:

- 588 electronic components
- 21 ICs from 10 different manufacturers

Source: Ericsson SH888 GSM Mobile Phone Performance and Design Analysis, Report #110-991220-1f, Portelligent Inc.

- time-frame for analysis mostly below ½ year
- suitability of generic data uncertain

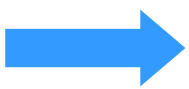
→ Quick method for assessment of existing and newly required data needed

Product data of EE products: Question 1

Is it possible to give an averaged material composition for the same component for each case size from different manufacturers?

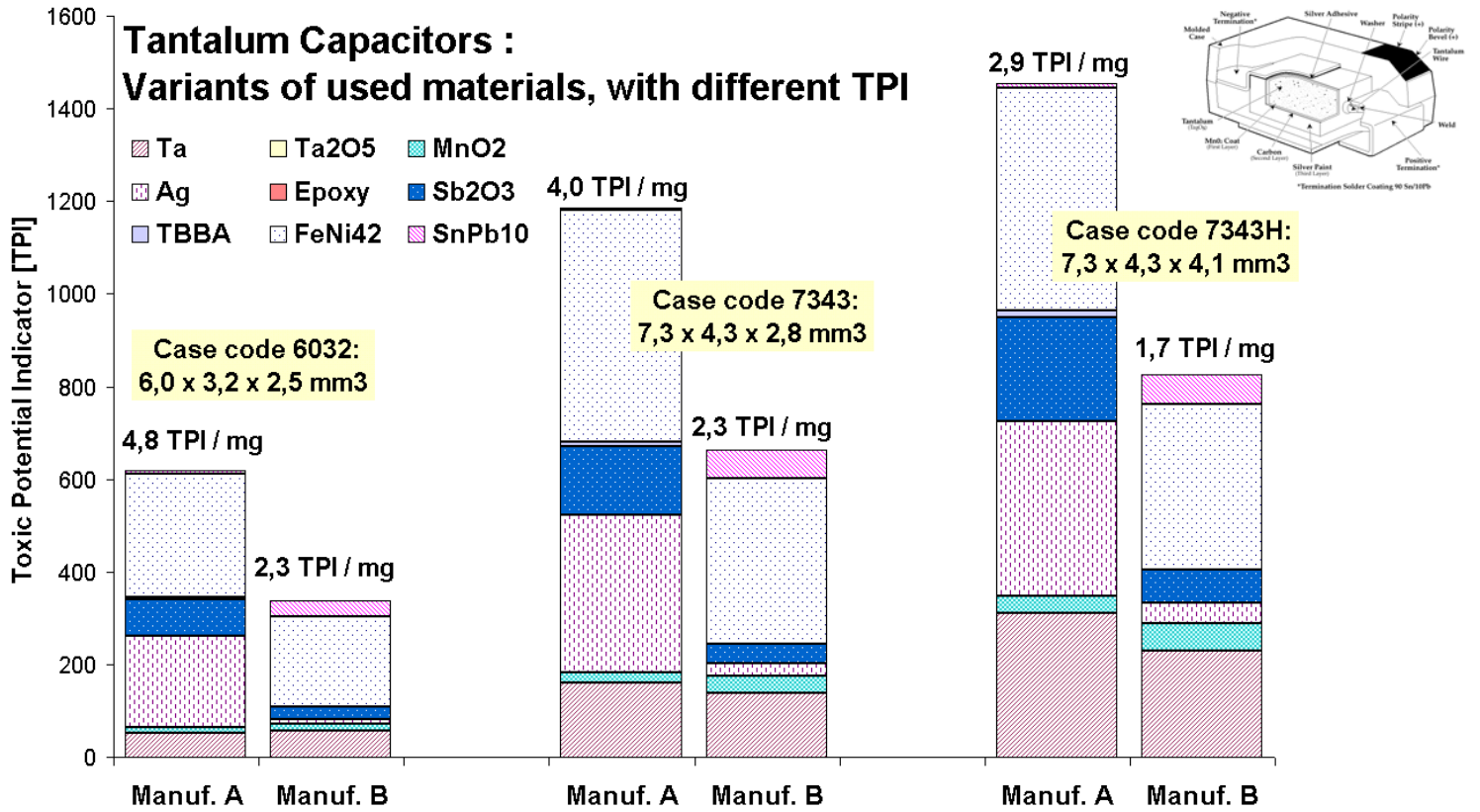
Components of electronic products:

Up to hundreds of manufacturers / suppliers



Investigate each of them or develop Rules of Thumb?

Product data of EE products: Example 1



Capacity and rated voltage determine type and case size, e. g., Type T491 for 0.1–1000 µF, 4–50 V

Product data of EE products: Conclusion 1

Manufactures apply different technical solutions even for standard electronic components. Averaged data might hinder selection of the most environmentally-friendly components.

→ For generation of generic, component specific data, existing alternatives have to be analyzed.

→ Is it feasible to develop Rules of Thumb?

Product data of EE products: Question 2

Scalability of component-data: Do material composition and environmental assessment depend on electrical values?

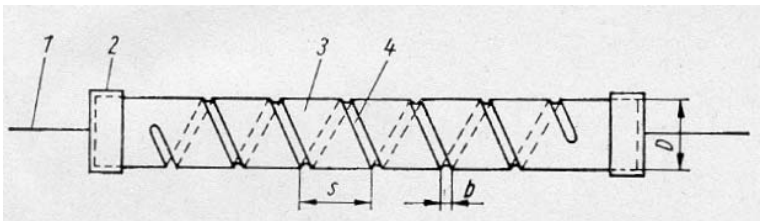
Bill Of Materials of electronic products:

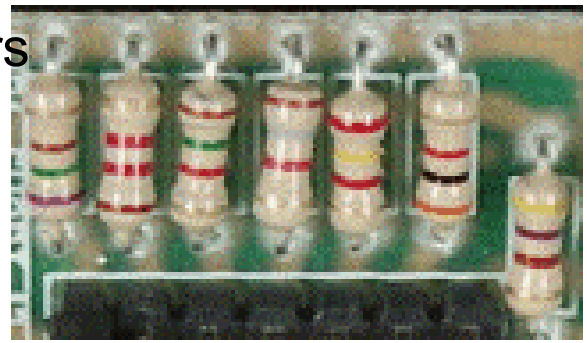
Up to hundreds of resistors, capacitors, IC´s

Investigate each of them or develop Rules of Thumb?

Product data of EE products: Example 2

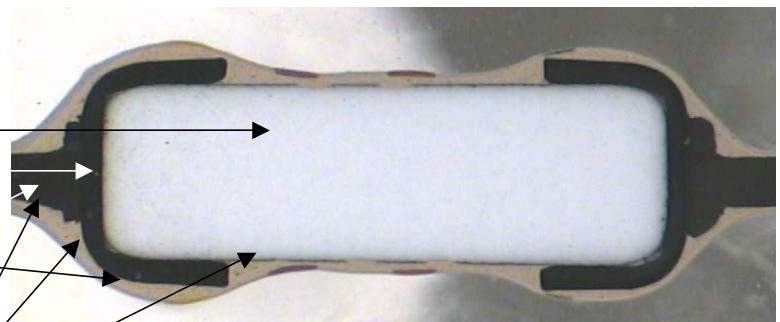
Example: Cracked carbon film resistors





R = 470 Ω - 47,000 Ω; Case: 0207 for all

For each R	[mg]	TPI	
Porcelain	35.8	6.4	body
Fe	28	0.0	caps
CuZn28	12	164.9	leads
Epoxy paint	4	3.5	coating
SnPb40	0.1	143.9	finish
Sn	0.08	0.9	finish
C	≈0.175	0.0	film



Product data of EE products: Conclusion 2

In the case of carbon film resistors, the electrical value doesn't make any difference for environmental assessment. But, for other types of resistors it may be different!

→ Generic data sets might be useful for some standard components - but area of validity has to be clearly defined!

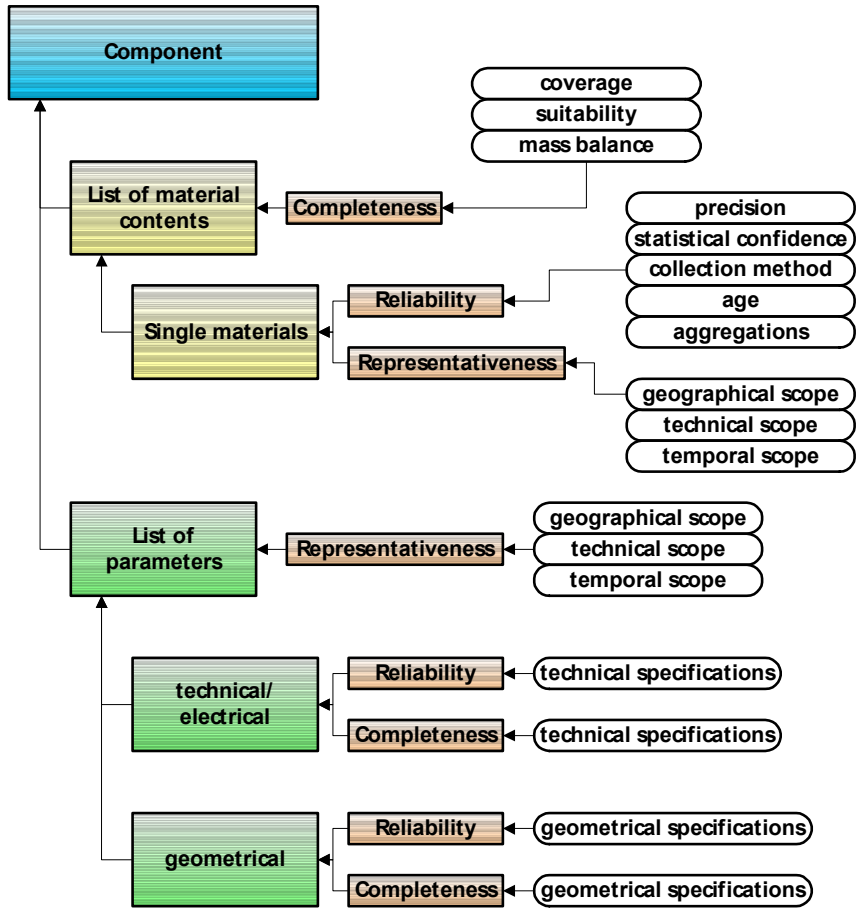
→ Investigation of standard components feasible?

Conclusions from Example 1 & 2

- Assessment of design alternatives in electronics requires detailed analysis of the bill of materials - even standard components of the same electrical specification show significant differences
- Generic data sets and Rules of Thumb could be set up for some components - however, further data is necessary for the selection of a fitting data set and checks of validity
- Hence, data quality assessment is very important!

Data quality assessment

- As follows from the Eco-Design requirements in the electronics industry, data quality assessment has to be fast, simple, and manageable
- Pedigree matrices
- Aggregation criteria



Final conclusion

- Applicability of already existing data or generic data for the assessment of EE products and processes has to be checked
- Data quality indicators needed to quantify and communicate these uncertainties
- Especially important for decision support in eco-design processes: Uncertainties might be as high as the effects of design changes
- Life-Cycle Management will benefit from upcoming efforts for a standardization of material declaration and supply chain management - if flexible data quality assessment methods and data quality criteria are standardized as well