Apex Microtechnology
Submission for beryllium and its compounds

1. General questions

a. In past processes for identifying substances of relevance for possible restriction under RoHS, only beryllium metal and beryllium oxide were considered. The current assessment looks at a broader scope in this respect, namely beryllium and its compounds. Please specify, should a restriction be considered, if it should be limited to beryllium metal and beryllium oxide or expanded to include beryllium and its compounds.

Apex Microtechnology:

We do not believe a restriction should be considered for beryllium metal, beryllium oxide or its compounds. No other available material meets the same thermal and electrical characteristics.

b. Please provide information to support your view, including information as to the use and presence of additional beryllium compounds in EEE placed on the EU market (e.g. beryllium–copper alloy, beryllium sulfate, beryllium chloride etc).

Apex Microtechnology:

In addition to BeO's high thermal conductivity, critical to component and system reliability, thick film materials necessary to produce such power electronic microcircuits are available and proven for use on BeO. Alternative ceramic substrates lack the thermal conductivity and/or the thick film systems required for the manufacturing of these compact electronic microcircuits.

For example, reliable thick film systems exist for aluminum oxide (Al_2O_3) substrates however, the lower thermal conductivity of Al_2O_3 makes it unsuitable as an alternative to BeO thus eliminating Al_2O_3 as an alternative for microcircuits used in these systems.

Aluminum Nitride (AlN) provides thermal conductivity equivalent to BeO but, lacks thick film systems necessary for high-power microcircuits. For decades thick film system suppliers have attempted to develop materials compatible with AlN to no avail. These attempts have failed with no promise of a complete thick film system within the foreseeable future.

2. Applications in which beryllium metal and beryllium oxide are in use

a. Please provide information concerning products and applications in which the substances are in use.

Apex Microtechnology:

BeO is used as the substrate material of high power electronic microcircuits including power operational amplifiers, power switching amplifiers and motor drives produced by Apex Microtechnology Inc. Apex microcircuits are used by our customers in critical military/aerospace, industrial and medical systems where high thermal conductivity and electrical isolation of BeO are

critical to the performance and reliability of these systems. Other available ceramic substrate materials lack critical properties and capabilities provided by BeO.

b. Please specify if you are aware, if aside from actual use of the substances, it may be reintroduced in to the material cycle through the use of secondary materials.

Apex Microtechnology:

To the best of our knowledge, BeO from our product would not be reintroduced.

5. Substitution

a. Please provide details as to the substitution of beryllium and its compounds (as a minimum for beryllium metal, beryllium oxide and beryllium copper alloys):

Apex Microtechnology:

Aluminum Nitride (AlN) provides thermal conductivity equivalent to BeO but, lacks thick film systems necessary for high-power microcircuits. For decades thick film system suppliers have attempted to develop materials compatible with AlN to no avail. These attempts have failed with no promise of a complete thick film system within the foreseeable future.

Apex Microtechnology Corporate Headquarters:
5980 N Shannon Rd
Tucson, AZ 85741, USA
Phone +1(520)690-8600
Email: info@apexanalog.com
www.apexanalog.com

Regional Sales Contacts:

USA (East)
Aaron Bondy
Phone +1 (520) 500-7268
tom.schmitt@apexanalog.com

USA (West)
Phil DiPaolo
Phone +1 (480) 278-6993
phil.dipaolo@apexanalog.com

Canada, Asia & Pacific
Mike Dormanen
Phone +1 (520) 248-1321
mike.dormanen@apexanalog.com

South America, Other Areas
Arco Snoey
Phone +1 (520) 245-1805
arco.snoey@apexanalog.com

EMEA
Erwin Nieuwenhuizen
Phone +31 (0)650855230
erwin.nieuwenhuizen@apexanalog.com