

This comment is made by Integrated Photonics, Inc. (IPI) as part of the stakeholder consultation on adaptation to scientific and technical progress under the Annex to the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment for the purpose of a possible amendment of the Annex. This comment pertains to Exemption 22 “Lead as impurity in RIG (rare earth iron garnet) Faraday rotators used for fibre optic communications systems.”

- This exemption was originally applied for by Sumitomo Metal Mining Co., Ltd. and the Japan Electronics and Information Technologies Industry Association (JEITA) on behalf of NEC Corporation and Murata Manufacturing Co., Ltd. In that application, it was asserted that it was not technically possible to meet the RoHS Maximum Concentration Value for lead (Pb) of 1000 wt. ppm in the garnet Faraday rotator.
- In the Draft Decision of the European Commission no contrary information was available so this exemption was recommended.
- In November 2005, Integrated Photonics, Inc. became aware of the consultation and presented information on the compliance of their Faraday rotator garnets. Since 2001, Integrated Photonics has been marketing garnet Faraday rotators with a lead concentration of less than 1000 wt. ppm. In fact, IPI’s MGL material is lead-free. Integrated Photonics has, for seven years, been producing and delivering Faraday rotators that meet all six RoHS Maximum Concentration Value limits. IPI has thus clearly demonstrated that the RoHS limits are technically and scientifically possible without need for an Application Exemption.
- Extensive testing by two independent third party laboratories has confirmed that IPI’s Faraday rotators meet all six Maximum Concentration Values for restricted substances, notably lead (Pb), the subject of the exemption in question. A full methods validation has shown that the most accurate method for lead determination in Faraday rotators is Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) using matrix matched calibration standards. Systems calibrated in more conventional fashion using non-matrix matched standards have risk of systematic error, notably Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES, also known as ICP-AES), which gives erroneously high values without a matrix-matched standard.
- The monolithic, homogenous, lead-containing component in question is the single crystal garnet Faraday rotator that is central to magneto-optic isolators and other non-reciprocal devices used in optical communications systems. This material is typically grown by liquid phase epitaxy (LPE) from a lead oxide-containing solution. The incorporation of lead into the final crystal is an artifact of the growth process and is incidental to the desired properties of the device. Therefore reduced lead or lead-free Faraday rotators are essentially identical in form, fit and function to existing lead-containing products. They have the same structure. They are the same chemically. They are the same mechanically. They have essentially the same magnetic and optical properties. They meet the same specifications. The only difference is that their lead content is less than the MCV.
- The Final Report of the Öko Institut *Adaptation to Scientific and Technical Progress under Directive 2002/95/EC* states “Against the background and regarding the criteria given in Article 5 (1) (b) there is no reason to grant this exemption request.” (http://ec.europa.eu/environment/waste/pdf/rohs_report.pdf section 6.4)
- Nevertheless, this exemption was granted because of the required timing of a decision.
- In January 2007 a consultation on withdrawing this exemption closed. Integrated Photonics presented ample information on why this exemption should be withdrawn. All the information and discussion in this submission remains valid. No opposing information was publicly filed by any stakeholder. For the complete text see http://circa.europa.eu/Public/irc/env/rohs_6/library?l=/exemption_requests/impurity_communications/consultationpdf/IT_1.0_&a=d.
- Öko-Institut Report 2007; Annex 1 Monthly Report 6 states “Against the above mentioned background and with regard to the criteria given in Article 5 (1) (b) the existing exemption for ‘Lead as impurity in RIG (rare earth iron garnet) Faraday rotators used for fibre optic communications systems’ should be revoked. Also taking into account that the environmental impact of granting or not granting the exemption request is negligible the existing exemption should be revoked in order to support innovation and to promote early efforts for substitution.”
- **Since that report was issued three additional manufacturers have introduced six of six RoHS compliant Faraday rotators.**

- Granopt, a joint venture of Sumitomo Metal Mining and Mitsubishi Gas Chemical, is the highest volume OEM supplier of Faraday rotators. They announced RoHS compliant materials prior to the Optical Fiber Communications Conference in February 2007. See http://www.granopt.jp/e_file/new.html. These products are notably identical in form, fit and function to previous non-compliant products and have identical technical specifications.
- Shin-etsu has announced three lead-free Faraday rotator materials and devices made from them. See their January 2007 press release <http://www.shinetsu.co.jp/e/news/s20070119.shtml>.
- Namiki Precision Jewel announced RoHS compliant Faraday rotators in advance of the Optical Fiber Communications Conference in February 2008.

Clearly there is ample worldwide capacity of RoHS compliant Faraday rotators with multiple vendors.

- Since Integrated Photonics first announced fully compliant Faraday rotators, component and system users of Faraday rotators, isolators and isolated laser modules have had more than two years to qualify IPI's products and RoHS compliant products made by our customers. Granopt and Shin-etsu material and devices have been available for qualification for over a year. There is no conceivable reason why any equipment manufacturer should not have had ample time to perform adequate qualification should they have desired and made a good faith attempt to do so. Because new compliant Faraday rotators are identical in form, fit, function, technical specifications and even composition (omitting the lead impurity of course), qualification is a relatively trivial matter only important at the first level of device manufacture.
- The overall quantity of lead in optical isolators and its solubility against dissolution are not appropriate considerations for an exemption under the Directive, which is intended to encourage innovation in producing environmentally friendly products. While this is a relatively small mass application, it is an important litmus test for the seriousness of the European Union about stimulating technical innovation to achieve compliance with the Directive. The RoHS Directive does not distinguish applicability based on total quantity of lead or likelihood of release into the environment. Only the percentage Maximum Concentration Values are specified. There is nothing in the Directive that suggests that the amount of lead used per application, the lead content in the homogeneous material, the annual production volume or the number of applications put on the EU market annually should be criteria in determining an exemption. To quote the final report of the Öko Institut, "the question behind any decision is more about innovation and competitiveness in the market." (p. 20)
- This exemption has actively discouraged innovation and adoption of the existing fully RoHS compliant solution for Faraday rotators. It could also discourage innovation and adoption of technical and scientific progress in other, unrelated applications. An unnecessary exemption could thus set an unfortunate precedent: parties seeking other Application Exemptions would have reason to argue their case based on factors such as supplier capacity, qualification time, material dissolution time, etc. – not technical and scientific feasibility as called for by the Directive.
- At this point, the recommendation to revoke this exemption has sat without action for a year.

As stated in the RoHS Directive, Article 5 – Adaptation to scientific and technical progress, paragraph 1, section b, materials may be exempted "if their elimination . . . *is technically or scientifically impracticable*, or where the negative environmental, health and/or consumer safety impacts caused by substitution are likely to outweigh the environmental, health and/or consumer safety benefits thereof;" (emphasis added). As has been amply demonstrated by multiple vendors, **it is technically and scientifically practical to manufacture RoHS compliant Faraday rotators without recourse to an exemption.** There are therefore no grounds for this exemption to continue to exist. This point of view is confirmed by multiple reports of the Öko Institut. We therefore request to the Technical Adaptation Committee, the European Commission, and the European Parliament that this exemption be revoked at the earliest possible date.

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