Application of Dielectric Properties of Dental Material in Non-Destructive Testing

Mária Pápežová, Dagmar Faktrová
Department of Measurement and Applied Electrical, Faculty of Electrical Engineering, University of Žilina, Univerzitná 8215/1, 010 26 Žilina, Slovakia, e-mail: maria.papezova@fel.uniza.sk, dagmar.faktorova@fel.uniza.sk

The structural entirety of any biomaterial has to be tested to inhibit to untimely failure and thus maintaining the reliability of the replacement. The knowledge of dielectric properties (relative permittivity, loss factor) of biomaterial without defects in defined microwave frequency range (8–12 GHz) and subsequently comparing properties in defective material as changes in material and classifying the occurrence of inhomogeneities as on the surface so inside the structure. This article deals with possibility to create dental phantom with the same properties as used in practice and dielectric properties measurement method (Hippel method). We made phantom from poly methyl methacrylate (PMMA). PMMA is very commonly used dental material as crown of human tooth or as the crown for intra-osseous dental implantant.

Keywords: Dental material, Dielectric properties, Non-destructive testing

Acknowledgement

This work was supported by grant of the Slovak Grant Agency VEGA project No. 1/0846/1. "Design and optimization of methods and materials used at high frequency electromagnetic field therapy of cancer diseases."

References

[1] OMAR, M. (2012). *Nondestructive Testing Methods and New Applications.* Croatia : Intechweb.org, pp.53-68, ISBN 978-953-51-0108-6

[2] ŠIMUNEK, A.a kol. (2008). *Dentalní implantologie.* Praha: NUCLEUS HK, pp. 236-249, ISBN 978-80-87009-30-7

[3] RONALD L. SAKUGUSHI, JOHN M. POWERS. (2012). *Craig's Restorative dental materials.* Philadelphia: ELSEVIER, ISBN: 978-0-3230-8108-5

[4] BANSAL, R. (ed.). (2005). *Handbook of engineering electromagnetics.* New York: CRC Press, pp.110-127, ISBN 0-203-02602-0

[5] POZAR, DAVID M. (2012). Microwave engineering. s.l.: *John Wiley & Sons*, pp.110-127, ISBN 978-0-470-63155-3

[6] SHEEN, J., Mao, W.L. (2007). Weishsing. Study on the Measurements Techniques of Microwave Dielectric Properties, *Proc. NST2007*, pp. 349-352

[7] FAKTOROVÁ, D. (2014). *Základy mikrovlnných meraní*, EDIS – vydavateľstvo Žilinskej univerzity, Žilina, pp. 101-106

[8] ĎURICA, M. *Rozšírenie frekvenčného rozsahu VNA do pásma X*. PhD Thesis. Bratislava, Slovak Tech. U.

[9] http://www.itis.ethz.ch/virtual-population/tissue-properties/database/dielectric-properties/, [20.5.2015, Online]

[10] FAKTOROVA D., PAPEZOVA M., SAVIN A., STEIGMANN R., NOVY F., BOKUVKA O. (2015). Microwave Resonant Methods for Bone Replacement Biomaterials Testing. *Procedia Engineering*, 100: 1686-1695

[11] BAKALOVA T., KOLINOVA M., LOUDA P. (2014). Micro CT Analysis of Geopolymer Composites. In: *Manufacturing Technology*, December, vol.14, no.3, p.505-516. ISSN 1213-2489

Paper number: M2015118
Copyright © 2015. Published by Manufacturing Technology. All rights reserved.