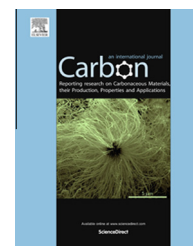


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Multifrequency X,W-band ESR study on photo-induced ion radical formation in solid films of mono- and di-fullerenes embedded in conjugated polymers

A. Konkin ^{a,*}, U. Ritter ^a, P. Scharff ^a, G. Mamin ^b, A. Aganov ^b, S. Orlinskii ^b, V. Krinichnyi ^c, D.A.M. Egbe ^d, G. Ecke ^a, H. Romanus ^a

^a Center for Micro- and Nanotechnologies, Ilmenau University of Technology, Gustav-Kirchhoff-Str. 7, D-98693 Ilmenau, Germany

^b Institute of Physics, Kazan Federal University, Kremlyovskaya St. 18, Kazan, Russia

^c Department of Kinetics and Catalysis, Institute of Problems of Chemical Physics, Semenov Avenue 1, Chernogolovka, Russia

^d Linz Institute for Organic Solar Cells, Altenberger Str. 69, A-4040 Linz, Austria

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ABSTRACT

Anion–cation radical formation in solid films of M3EH-PPV blended with C₆₀-PCBM, C₁₂₀-O-PCBM and C₆₀-MDHE, C₁₂₀-O-MDHE under diode laser (532 nm) and Xe-lamp light excitation studied by means of X,W-band at temperatures 30–80 K is reported. Subsequent high frequency W-band ESR data demonstrate the reproducible, but variable effect of appreciable dispersion (*D*) contribution in the ESR spectral line for the di-fullerene anion radicals. It is suggested that the increase of the *D* part relative to the absorption (*A*) in the summarized ESR absorption line in blends with difullerenes is caused by the higher value of difullerene medium conductivity. The obtained data are quantitatively discussed by the $D/A \sim F(d/\delta)$ functional dependence in approach of plane film geometry, where *d* is the film thickness and δ is the skin-depth. The influence of ν -dependent δ at *D/A* value has been checked using X-band LESR.

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1. Introduction

New effective electron acceptor composites for photovoltaics continue to be in the focus of goals for the application and understanding of the fundamental aspects of electron transfer in solid organic solar cells (OSCs). While mono-fullerenes and their various mono-adducts establish a good reputation as electron acceptors in mediums with conjugated polymers [1], wide popularity is however not the case for the fullerene

dimmers and their adducts, mostly due to the lack of research on this subject. Regarding the possibility of di-fullerene use as electron acceptors in OSC blends, one feature should be considered beforehand, notably the possibility for registration of dianion/diradical formation under light excitation. In regard to monofullerenes, the reduction to C₆₀⁽ⁿ⁻⁾ (*n* = 2, 3, 4, 5) can be obtained electrochemically and the corresponding oligo-radicals were certainly registered by ESR [2]. However, registration of the photo-induced *n*-anion in monofullerenes in

* Corresponding author.

E-mail address: alexander.konkin@tu-ilmenau.de (A. Konkin).

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