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L. Khomenkova, P. Normand, F. Gourbilleau, A. Slaoui, C. Bonafos

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L. Khomenkova[1,2,3,*], P. Normand[4], F. Gourbilleau[3], A. Slaoui[5], C. Bonafos[2]

[1] V.Lashkaryov Institute of Semiconductor Physics of NASU, 45 Pr.Nauky, 03028 Kyiv, Ukraine

[2] CEMES/CNRS, Université de Toulouse, 29 rue J. Marvig 31055 Toulouse Cedex 4, France

[3] CIMAP, CEA/CNRS/ENSICAEN/Unicaen, 6 Blvd Marechal Juin, 14050 Caen Cedex 4, France

[4] INN / NCSR Demokritos, 15310 Aghia Paraskevi, P.O.Box 60228, Athens, Greece

[5] ICube, 23 rue du Loess 67037 Strasbourg, France

[*)]Corresponding author: L. Khomenkova,

e-mail: khomen@ukr.net, phone +38-044-5255775; fax: +38-044-5258243

Abstract. High-k stacked dielectric structures were fabricated by a combination of RF magnetron sputtering and plasma-enhanced chemical vapor deposition. Their structural properties were studied versus deposition and annealing conditions by means of attenuated total reflection and high-resolution transmission electron microscopy techniques. All samples demonstrated smoothed surface (with a roughness below 1 nm) and abrupt interfaces between the different stacked layers. No crystallization of Hf-based layers was observed after annealing at 800°C for 30 min, demonstrating their amorphous nature and phase stability upon annealing. Uniform capacitance-voltage characteristics were measured along the wafers for all stacks. Besides, after round-voltage sweep they demonstrate significant flat-band voltage hysteresis due to charging of the stack caused by carrier injection from the substrate. These phenomena were found to be more pronounced for the stacks with pure HfO_2 layers. The stacked structures were implemented for the formation of Ge nanocrystals by means of ion implantation followed by the thermal treatment mentioned above. It was found that the spatial distribution of Ge crystallites in stacked dielectrics affects significantly their electrical properties including the trapping of charge.

Keywords: High-k dielectrics; RF magnetron sputtering; Plasma-enhanced chemical vapor deposition; Memory effect.