# A water-based antibacterial nanohybrid solution for coating stainless steel

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**Introduction.** Due to its exceptional properties, stainless steel (SS) is widely used in the daily life (food industry, household appliances, surgery …)[1]. However, it is unable to prevent bacteria from adhering, proliferating and forming a resistant biofilm when ageing. Therefore, surface modification is needed for providing durable antibacterial properties. Various techniques are used for imparting such biocidal properties to the support such as (i) the deposition of biocidal metals (such as silver and copper) or inorganic oxides ($TiO_2$ anatase) by plasma[2], chemical vapor deposition (CVD)[3] or sol-gel procedures[4], (ii) the coating of the surface by paints containing antibiotics or other biocides[5], (iii) or by biocidal (bio)polymers such as antibacterial peptides or synthetic polymers containing ammonium groups[6]. Provided that the biocidal polymers are anchored to the support, they impart long tasting antibacterial properties which are highly desirable for the durability of the functionality[6].

**Results and discussion.**Very recently, we reported on an all-in-one approach to prepare refillable antimicrobial films[7] using the layer-by-layer (LbL) deposition of polyelectrolytes. Specifically designed biocidal multilayered polyelectrolyte films that bear 3,4-dihydroxyphenylalanine (DOPA), known as a promoter of adhesion to inorganic surfaces, were deposited onto SS. DOPA was incorporated in the polycationic chains by radical copolymerisation of *N*-methacrylated DOPA with the quaternary ammonium salt of 2-(dimethylamino)ethyl methacrylate (DMAEMA+). In order to boost the antibacterial activity of the polycationic layer, AgNO3 was added to the aqueous solution of P(DOPA)-*co*-P(DMAEMA$^+$), which resulted in the in-situ formation of silver based nanoparticles, sources of biocial $Ag^+$. The layer-by-layer deposition of aqueous P(DOPA)-*co*-P(DMAEMA$^+$)/AgCl/Ag0 suspension and aqueous solution of poly(styrene sulfonate) provided high antibacterial activity against Gram-negative *E. Coli* bacteria.

Although this surface modification is highly efficient, it requires the LBL deposition of about 60 bilayers that makes the process difficult to scale-up. In the present communication, we will demonstrate how the same copolymers can impart AB properties to the SS surface using only 1 or 2 layers. Novel nanohybrids are first formed in water before being deposited on the surface.

**Conclusions.** The method of formation of these nanohybrids, their deposition and the characterization of the modified surface will be discussed in detail in this talk. This novel “water-based” approach is convenient, simple and is promising for scalable applications. It might also be used for coating other organic and inorganic surfaces in order to impart them AB properties.

**Acknowlegments.**The research was partly supported by BELSPO in the frame of IUAP VI/27 and Région Wallonne, ArcelorMittal and ULg through the PPP program BIOCOAT. C.D. is “Maître de Recherche” of the F.N.R.S. (Belgium), and thanks the F.R.S.-F.N.R.S. for financial support.

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