On-surface synthesis of differently shaped nanographenes

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**Abstract:** In recent years we observe renewed interest in the development of electronics based on electron transport through single molecules. This has focused the researcher attention on the synthesis and detailed characterization of single molecules, which are the building blocks of novel devices. Among different families of organic species, nanographenes hold the special position due to their intriguing electronic and magnetic properties. In particular a lot of effort is undertaken to achieve efficient synthetic strategies to generate such well-defined sections of graphene or graphene-like modules with diverse topological modifications. However, the insolubility of large polycyclic aromatic hydrocarbons limits the applications of conventional chemistry methods. An attractive alternative to the solution chemistry is based on its combination with the on-surface synthesis approach. Such method involves sequential steps, i.e. design and synthesis of suitable molecular precursors with sufficient solubility to be purified by conventional approach followed by the final step, where the oligomerization or planarization is achieved on a target substrate surface. Importantly, there is an increasing interest in the controlled and intended incorporation of non-hexagonal rings within newly designed nanographenes. A relevant examples of this approach present the synthesis of peripentacene [1], peritetracene [2] or planar nanographenes with azulene moieties [2,3]. Herein we present the on-surface generation of different nanographenes, as well as the detailed study of their electronic structure on the Au(111) surface. Our method is based on the thermally induced sequential cyclodehydrogenation of a stable and easily handled molecular precursors. High-resolution non-contact atomic force microscopy (NC-AFM) imaging was applied for the detailed visualization of the internal structure of the intermediates, as well as the target nanographenes with diverse topologies, i.e. including three-fold symmetric compounds generated by fusing 22 benzene rings distributed within three embedded peripentacene moieties [4], nanographenes with incorporated 5-membered rings and three-fold symmetric flakes with newly synthesized non-planar [14]annulene moieties. Additionally we will also demonstrate that nanographenes could be efficiently synthesized on non-metallic substrates.

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