Efficient orange emissive carbon nanodots

With the support by the National Natural Science Foundation of China and the Chinese Academy of Sciences, the research team led by Prof. Qu Songnan (**曲松楠**) at the State Key Laboratory of Luminescence and Applications, Changchun Institute of Optics Fine Mechanics and Physics, Chinese Academy of Sciences, developed strong orange emissive carbon nanodots (CDots) with a fluorescent quantum yield of up to 46%, surpassing previously reported yields of 24%—26% for red-emissive CDots, which was published in *Advanced Materials* (2016, 28(18): 3516—3521).

CDots have attracted broad research interest in recent years, because they provide carbon nanomaterials with excellent photoluminescent properties. Their distinct advantages, such as low toxicity, good luminescent properties, biocompatibility, low cost and widely available raw materials, make CDots superior to conventional fluorescent materials. Strong blue and green emissive CDots with high photoluminescent (PL) quantum yields have been developed. However, efficient long-wavelength (orange and red light regions) emissive CNDs are very scarce due to lack of effective synthesis methods and the blur luminescence mechanism, which greatly hinder their development and applications.

Over the past 5 years, Prof. Qu's team has carried out many investigations on CDots. Their achievements include the development of a new type of green emissive CDot from citric acid and urea (*Angew Chem Int Ed*, 2012, 51(49): 12215—12218), the creation for the first time of optically pumped green lasers from CNDs (*Adv Funct Mater*, 2014, 24(18): 2689—2695), and the development of water-triggered luminescent nano-bombs based on supra-CDots (*Adv Mater*, 2015, 27(8): 1389—1394). In the current study, this team developed a new strategy for solvothermally synthesizing orange emissive CDots. They controlled the band gap of CDots by modulating the size of conjugated sp^2-domains, and demonstrated that the organic compound dimethylformamide (DMF) is a good solvent for the formation of CDots with larger sp^2-domains, which are the basis of orange emissions. Highly orange emissive CDots with PL quantum yield of 46% were achieved through surface metalcation-functionalization from the solvothermally synthesized CDots. Using these newly developed CDots, this team prepared efficient orange emissive CDot-based phosphors and manufactured warm white light-emitting diodes. This work may promote the development and application of CDots.

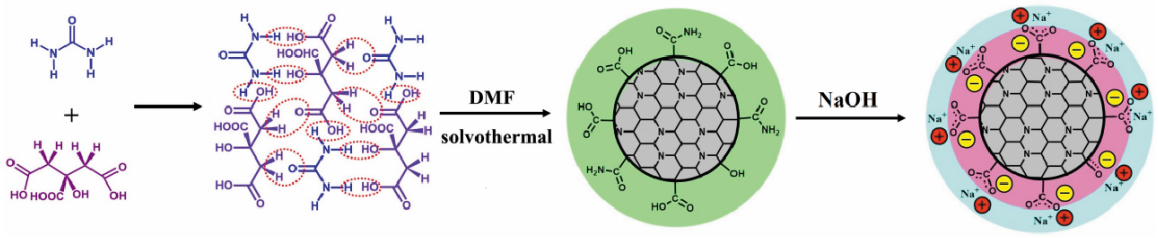

Figure A possible growth mechanism for the strong orange emissive CDots.