



Chimica Verde

Energie Rinnovabili

Salute

Materiali

Modelling

Beni Culturali

CONFERENZA DI DIPARTIMENTO 2019

DS^{CM}TM

Department of Chemical Sciences and Materials Technology

28-29-30 OTTOBRE
BRESSANONE
HOTEL GRÜNER BAUM



Consiglio Nazionale delle Ricerche
Dipartimento Scienze Chimiche e Tecnologie dei Materiali

© Cnr Edizioni, 2019
Piazzale Aldo Moro, 7 - 00185 Roma
www.edizioni.cnr.it - bookshop@cnr.it - 06 49932287

ISBN 978 88 8080 370 6

Atti della Conferenza del Dipartimento Scienze Chimiche e Tecnologie dei Materiali
Bressanone 28-29-30 ottobre 2019,
a cura di **Doriano Lamba e Francesco Verginelli**



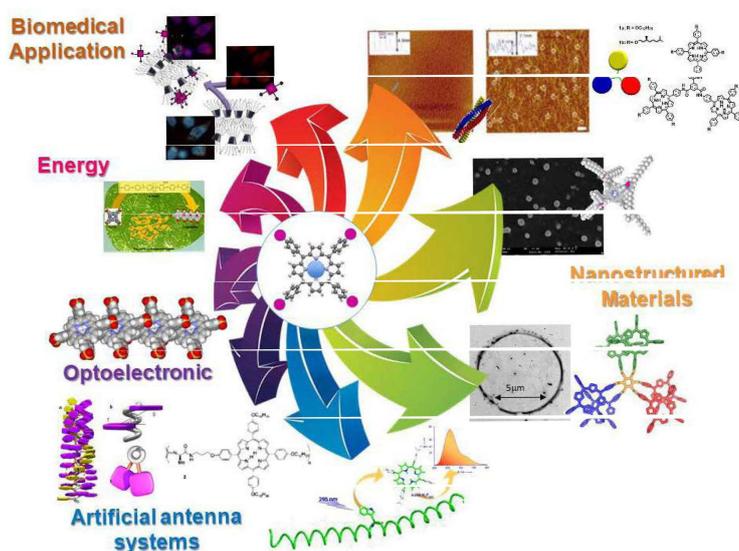
Non Covalent Porphyrin Architectures From Structure To Applications

Maria Angela Castriciano, Mariachiara Trapani, Roberto Zagami, Andrea Romeo, Luigi Monsù Scolaro

e-mail: maria.castriciano@cnr.it

Istituto per lo Studio dei Materiali Nanostrutturati (ISMN)

The remarkable recent progress in nanotechnology is mainly due to the ability to synthesize, investigate, and exploit materials with structural modulation on the nanometer scale. Porphyrins are well suited building blocks since they i) are relatively easy to synthesize; ii) show interesting and peculiar photophysical properties that can be tuned through careful choice of peripheral substituents and inserted metal ions and iii) are able to self-assemble spontaneously into dimers or higher aggregates through non-covalent interactions. Porphyrin structure features can be controlled in order to introduce and tune, in the self-assembled material, functional properties for a wide range of application spanning from catalysis, to sensors, optoelectronics or drug delivery. In particular, water soluble porphyrins are very interesting since, taking advantage of the self-correcting nature of the supramolecular interactions, defect-free structures can be achieved whose shape, size and photophysical properties are highly sensitive to external stimuli. In this framework, the water soluble tetrakis(4-sulfonatophenyl) porphyrin (TPPS₄) provides an iconic example of such behavior, since its diacid form, in particular experimental conditions, is able to self-arrange in well defined J-aggregates supramolecular structures. In the last decades, our investigations have been mainly focused on TPPS₄ self-aggregation phenomena, supramolecular organization on biological matrices and in confined environments. The data reported on this system have allowed to gain important information in the field of supramolecular architectures, highlighting the importance of the role of experimental parameters such as concentration and/or mixing order of the reagents. Here we report a detailed kinetic investigations to demonstrate the fundamental role of the various factors in controlling the assemblies sizing and the expression and transmission of chirality at nano and mesoscopic scale.¹ Furthermore, we report on aggregation templated by inorganic nanoparticles to realize hybrids nanocomposite materials² and an interesting example of new composite membranes, successfully tested as proton exchange material in fuel cells (PEMFC) technology.³



References:

1. Romeo, A.; Castriciano, M.A.; Zagami, R.; Pollicino, G.; Monsu Scolaro, L.; Pasternack, R.F. Effect of zinc cations on the kinetics for supramolecular assembling and the chirality of porphyrin J-aggregates. *Chem. Sci* 2017, 8, 961.
2. Carbone, A.; Gaeta, M.; Romeo, A.; Portale, G.; Pedicini, R.; Gatto, I.; Castriciano, M.A. Porphyrin/sPEEK Membranes with Improved Conductivity and Durability for PEFC Technology. *ACS Applied Energy Materials* 2018, 1, 1664-1673.
3. Trapani, M.; Castriciano, M.A.; Romeo, A.; De Luca, G.; Machado, N.; Howes, B.D.; Smulevich, G.; Scolaro, L.M. Nanohybrid Assemblies of Porphyrin and Au₁₀ Cluster Nanoparticles. *Nanomaterials* 2019, 9, 1026.