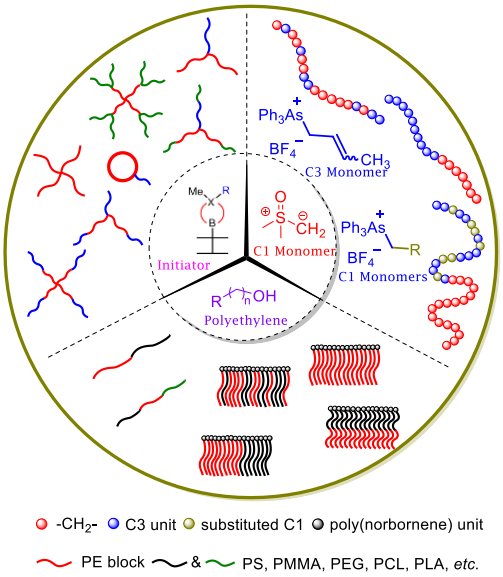
C1 and C3: The Forgotten Polymerizations

Nikos Hadjichristidis

King Abdullah University of Science and Technology (KAUST), Physical Sciences and Engineering Division, KAUST Catalysis Center, Polymer Synthesis Lab., Kingdom of Saudi Arabia

Unlike the well-known C2 polymerization of vinyl monomers (the chain is growing by two carbons at a time) and C4 polymerization of dienes (the chain is growing by four carbons at a time), the borane initiated polymerization of sulfoxonium and arsonium ylide monomers are leading to C1 (the chain is growing by one carbon at a time)[1] and C3 (the chain is growing by three carbons at a time)[2] chains.

By using appropriate ylides and trialkylboranes we were able to direct the polymerization either to C1 (dimethylsulfoxonium methylide) or C3 (methylallyltriphenylarsonium ylide) mode. These findings open new horizons towards the synthesis of polyethylene (PE)- and polymethylallyl-based unprecedented polymeric materials[3-20]. A few of them are given in Scheme 1.



Scheme 1. PE(**C1**)-and polymethylallyl(**C3**)-based polymers with complex macromolecular architectures

Selected References

[1] J. Luo, J., Shea, K. J. Acc. Chem. Res. ***2010****, 43, 1420-1433; [2] Goddard, J. P.; Lixon, P.; Le Gall, T.; Mioskowski, C. J. Am. Chem. Soc.* ***2003****, 125, 9242-9243; [3] Zhang, H., Alkayal, N., Gnanou, Y., Hadjichristidis, N. Chem. Commun.* ***2013,*** *49, 8952-8954; [4] Zhang, H., Gnanou, Y., Hadjichristidis, N. Polym. Chem.* ***2014****, 5, 6431-6434; [5] Zhang, H., Alkayal, N., Gnanou, Y., Hadjichristidis, N. Macrom. Rapid Commun.* ***2014,*** *35, 378-390; [6] Alkayal, N., Hadjichristidis, N. Polym. Chem.* ***2015****, 6, 4921-4926; [7] Zhang, Z., Zhang, H., Gnanou, Y., Hadjichristidis, N. Chem. Commun.* ***2015****, 51, 9936-9938; [8] Zhang, H., Gnanou, Y., Hadjichristidis, N. Macromolecules* ***2015****, 48, 3556-3562; [9] Wang, D., Zhang, Z., Hadjichristidis, N. ACS Macro Letters* ***2016****, 5, 387-390; [10] Zhang, H., Hadjichristidis, N. Macromolecules* ***2016****, 49, 1590-1596; [11] Zheng, Z., Altaher, M., Zhang, H., Wang, D., Hadjichristidis, N. Macromolecules* ***2016****, 49, 2630-2638; [12] Wang, D., Hadjichristidis, N. Chem. Commun.* ***2017****, 53, 1196-1199; [13] Wang, D., Zhang, Z., Hadjichristidis, N. Polym. Chem.* ***2017****, 8, 4062-4073; [14] Wang, D., Hadjichristidis, N. Chem. Comm.* ***2017****, 53, 1196-1199; [15] Alshumrani, R., Hadjichristidis, N. Polymer Chemistry* ***2017****, 8, 5427-5432; [16] Alkayal, N., Zhang, Bilalis, P., Gnanou, Y., Hadjichristidis, N. Macromol. Chem. Phys.* ***2017****, 10.1002/macp.201600568; [17] Zhang, Z.,Bilalis, P., Zhang, H., Gnanou, Y., Hadjichristidis, N. Macromolecules* ***2017****, 50, 4217–4226; [18] Zhang, Z., Hadjichristidis, N. ACS Macro Letters* ***2018****, 7, 886-891; [19] Wang, D., Hadjichristidis, N. Angew. Chem.Int. Ed.* ***2019****, 58, 6195-6299; [20] Jiang, Y., Hadjichristidis, N. Macromolecules* ***2019****, 52, 1955-1964.*