Bismuth coordination polymers with arylphosphonic acid esters

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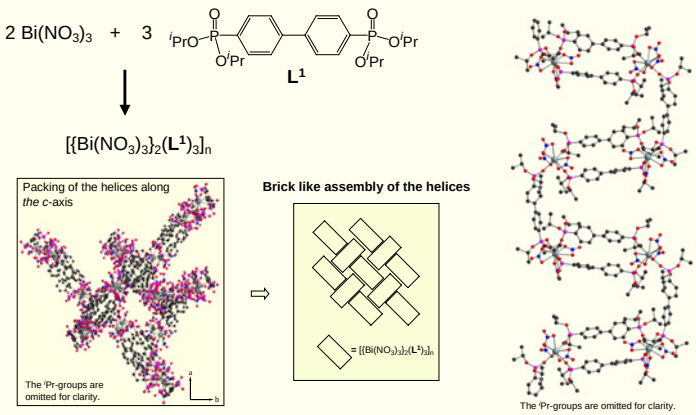
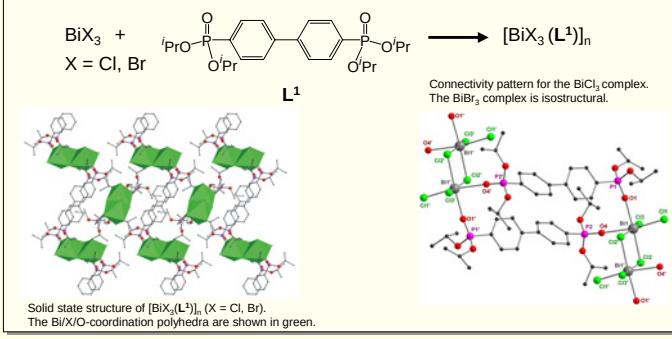
Coordination polymers are currently of considerable interest because of the prospect to produce novel materials with useful chemical properties. Some potential applications are ion exchange, catalysis, molecular sieving and sensing. However, the targeted synthesis of coordination polymers with well-defined properties is challenging and requires a thorough understanding of the factors which influence the formation of the framework structure.[1-4]

We are interested in the synthesis and structural characterization of coordination polymers build from inorganic bismuth salts and phosphonic acid esters. First results show that the reactions between phosphonic acid esters and bismuth halides or bismuth nitrate provide either molecular complexes with chelating ligands or more complex coordination polymers with bridging ligands.[5,6] Here we present the syntheses and structures of novel bismuth coordination polymers using the multifunctional phosphonic acid ester ligands 4,4'-$[(^iPrO)_2P(O)]C_6H_4C_6H_4[P(O)(O^iPr)_2]$ (**L¹**), $[4\text{-}\{(^iPrO)_2P(O)\}C_6H_4]_4Si$ (**L²**) and $1,3,5\text{-}[(^iPrO)_2P(O)]_3C_6H_3$ (**L³**).

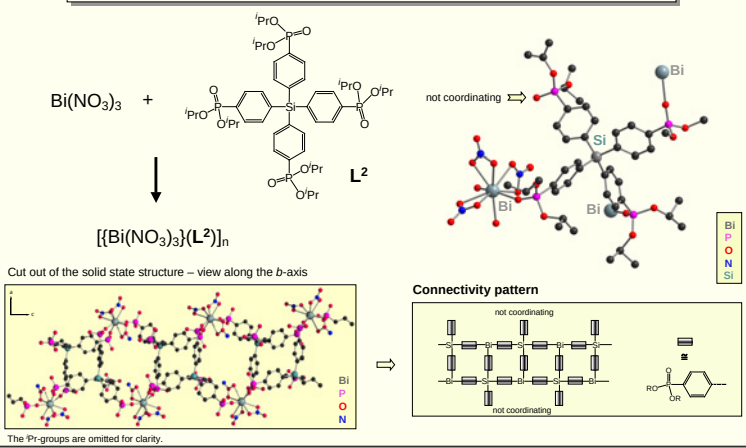
One-dimensional coordination polymer with helical structure



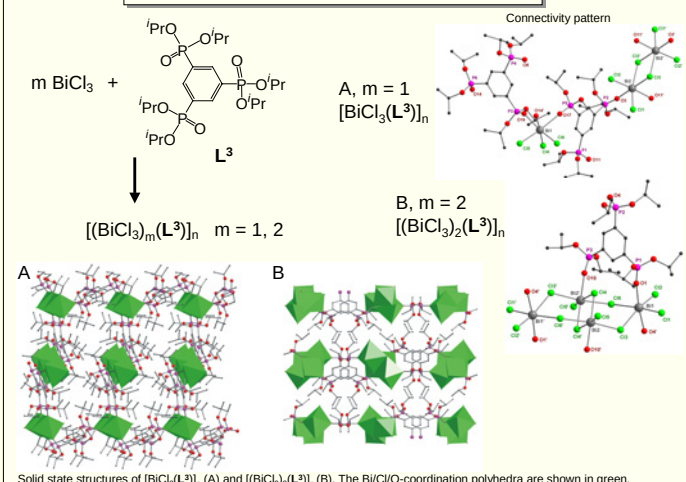
One-dimensional coordination polymers

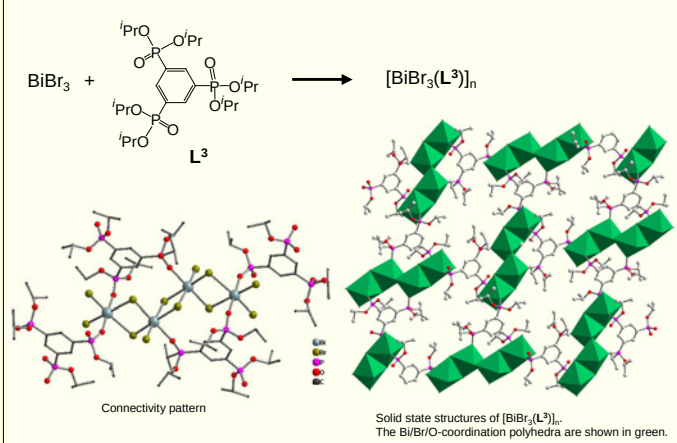


One-dimensional coordination polymer with ladder-type structure



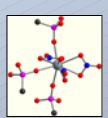
Two-dimensional coordination polymers



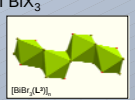


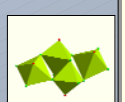
Conclusion

- One-dimensional coordination polymers were observed upon reaction of $Bi(NO_3)_3$ with multidentate bridging phosphonic acid ester ligands.
  - The bismuth atom is ninefold coordinated in the bismuth nitrate complexes. The nitrate groups are bidentate coordinating. Three phosphonic acid ester groups build a T-shaped arrangement.



- Two-dimensional coordination polymers were obtained upon reaction of BiX_3 (X = Cl, Br) with multidentate bridging phosphonic acid ester ligands.
  - Edge-sharing octahedra are observed for $[BiCl_3(L^3)]_n$, $[BiX_3(L^1)]_n$ (X = Cl, Br) and $[BiBr_3(L^3)]_n$.
  - In $[(BiCl_3)_2(L^3)]_n$ in addition to two edge-sharing octahedra two corner-sharing octahedra are observed.





- One- and two-dimensional coordination polymers are easily accessible whereas three-dimensional polymers were not obtained.

Literatur

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