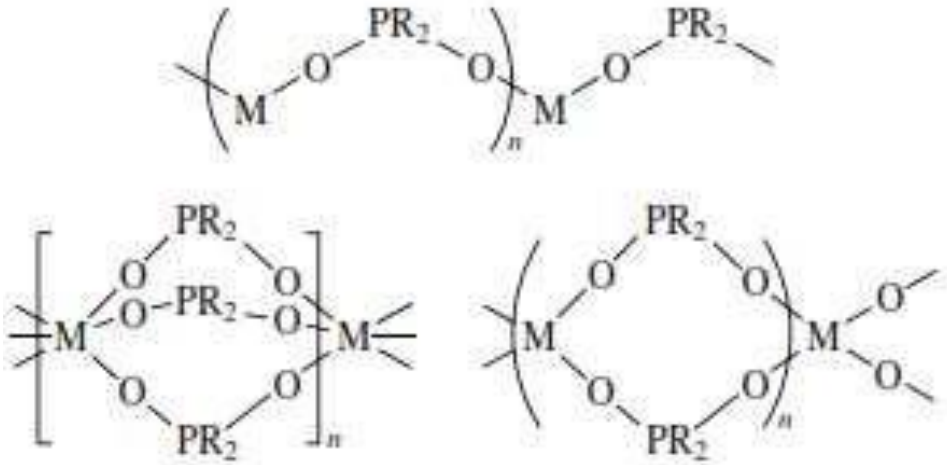
Classifications by dimensionality

- Another manner in which polymers can be classed is by dimensionality. Pittman use this classification for polymeric species containing metal atoms in their backbones. Here we will use the dimensionality for all types of inorganic polymers.

i. 1-D Polymeric Structures
ii. 2-D Polymeric Structures
iii. 3-D Polymeric Structures

1-D Polymeric Structures

- A linear chain polymer is categorized as a one-dimensional (1-D) polymer even though it may have twists and turns in the “linear” chain. Simple polymer chains in which all of the atoms in the chain have a connectivity of 2 are classed as 1-D polymers.
- However, a linear chain polymer with one or more atoms of each repeating unit having a connectivity of more than 2 is also possible. For example, a polymer with benzene rings in the chain will have some carbon atoms with a connectivity of 3.



Schematic metal phosphonate 1-D polymers with connectivities of 2–6.

2-D Polymeric Structures

- Simple inorganic species with a connectivity of 3 often lead to sheet or two dimensional (2-D) polymers as shown in Figure for boric acid & arsenic sulfide.
- On the other hand, connectivities do not always determine illustrate this point, the aqueous iron(II) oxalate polymer has structure, but the analogous 2,5-oxyquinonate complex of istructure as shown below in Figure.

iron(II) oxalate

3-D Polymeric Structures

- Inorganic polymeric networks in which bonding occurs in three dimensions are well known. Starting with quartz (SiO_2) as a prime example, the most common characteristic of such species is insolubility — unless decomposition occurs during a dissolution process.
- To have a true 3-D polymer, at least some of the atoms must have a connectivity of 4 or more. Some polymers, such as some of the polysilynes are pseudo-3-D as a result of 3-D ring formation to relieve steric strain.
- Prussian blue is a classic example of a mixed Fe(II) and Fe(III) 3-D polymeric structure, with each iron ion surrounded octahedrally by six cyano ligands.