Supramolecular Chemistry-I

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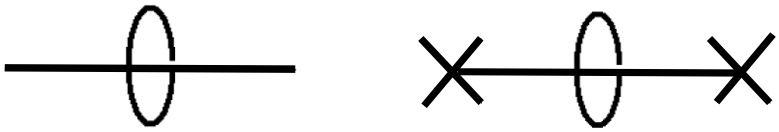
Week - 03

Lecture - 15

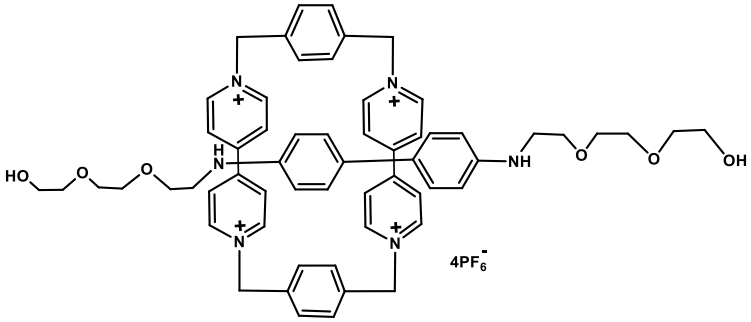
Good morning. So, today I will discuss interlocked structures and dendrimers I shall take up later. So, this particular interlocked structures we have one macrocycle and one rod-like linear molecule. This rod threaded into a macrocycle and this system is called a pseudo rotaxane. We call it pseudo because it is not really a rotaxane. In the following cartoons, the figure on the left is a pseudo-rotaxane while the one on the right is a rotaxane.



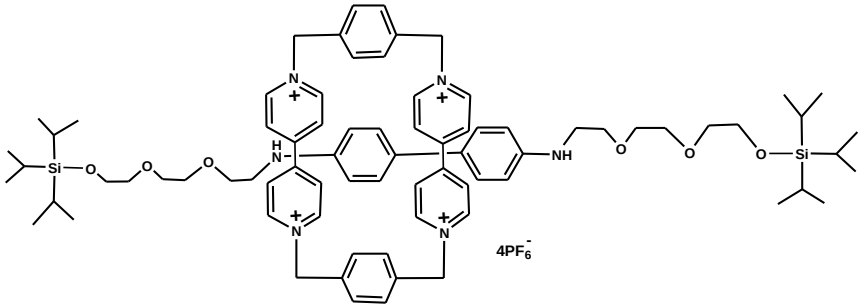
Pseudorotaxane Rotaxane

The difference between the two cartoons is that in the left one, the macrocycle can come out of the linear component and become two species. But in case of the right figure, the macrocycle cannot come out of the rod-like component because in this case, there are two stoppers at the ends. However, in both cases the macrocycle can move around the linear rod.

There are two components present in each figure. So, the left one is called 2-pseudorotaxane and the right one as 2-rotaxane. Below are two examples shown:

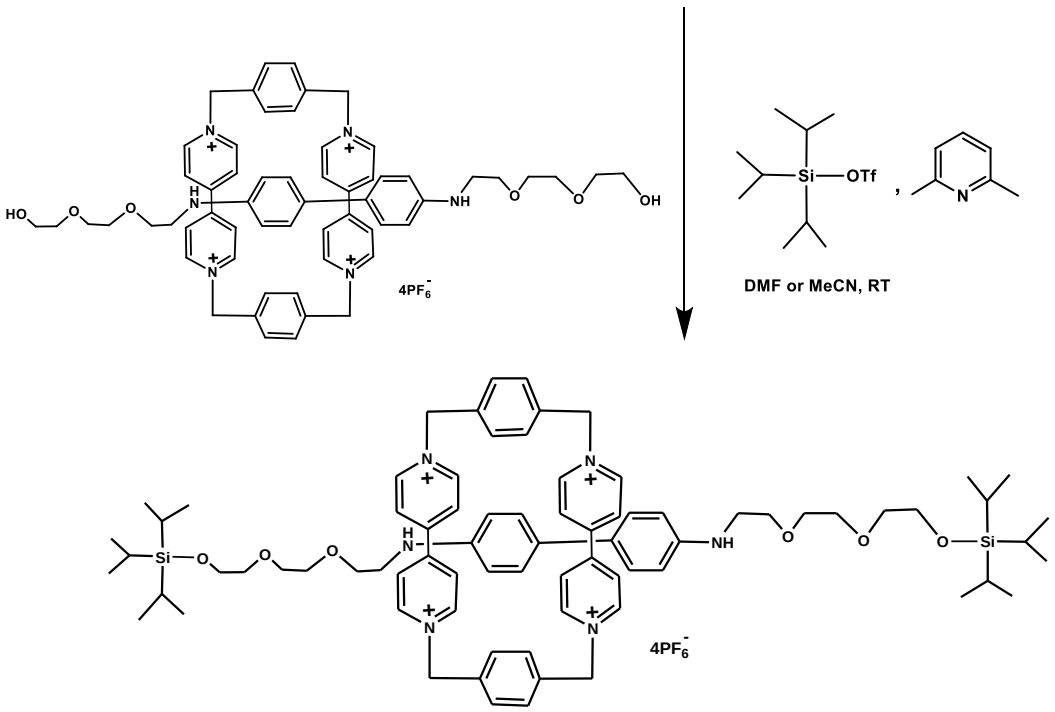


2-pseudorotaxane



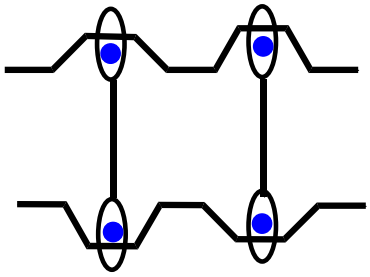
2-rotaxane

How to synthesize this compound? As you can understand when I have this pseudo-rotaxane, I take a macrocycle and then put the rod inside. Why will it go? It will go inside because the macrocycle has 4 positively charged aromatic groups. When it goes inside the linear rod-like compound it will have a strong π-π stacking with electron rich biphenyl group. But this π-π stacking interaction may not be substantial. So, when we give energy to the system in the form of say heat, the macrocycle will come out. Now, once it goes in, then I can put stoppers at the two ends so that the macrocycle cannot come out.



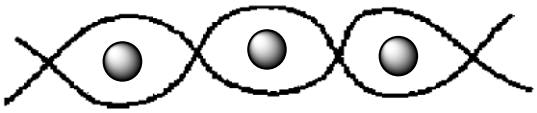
Let me write the two others and not only that you have this compound. Suppose this compound I am writing it. This is a linear rod, but I have drawn these two pattern just like

that and here you also have another unit. Here is another unit and then what can happen? You can put one here and one here connected and then you can put one here and one here connected. So, this we will call poly pseudo-rotaxane. This is a cartoon form.



Poly-pseudorotaxane

How this is formed? This is basically you have two macrocycles connected and I take two linear units and they will go inside to form this. Why will they go as shown? Because I have some groups here that the macrocycle can recognize. Of course, actual synthesis will be tough. Then another interlocked structure formed by two helices. Similarly, we can have triple helical structures. Double helical structure you have some idea from DNA double helix and there are triple helix structures also available.



Metal helicate

So, we will stop here today. So, next time other systems I will describe. Thank you.