Transition Metal Organometallics in Catalysis and Biology
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Module No # 09
Lecture No # 41
Olefin Polymerization (Part – 2)

Welcome to this course on transition metal organometallics in catalysis and biology we have been discussing olefin polymerization in the last few lectures. And the main focus of our discussion had been on the classification of olefin polymers that one can obtain through this olefin polymerization process. One thing for sure which is very much evident in our discussion so far that polymers of different properties can be obtained through this process and these properties can be very diverse.

For example they can be something very soft they can be something material which are soft there will be materials which are hard the materials which can be deformed material which will be resistant to deformation there would be materials which one's deform will retain the new shape and then the material which are one's the deformation is released stress is released and it goes back and has namely to its initial stage. So what we had come across is a wide variety of properties that can arise in polymers and based on this properties and their subsequent applications these polymers are classified.

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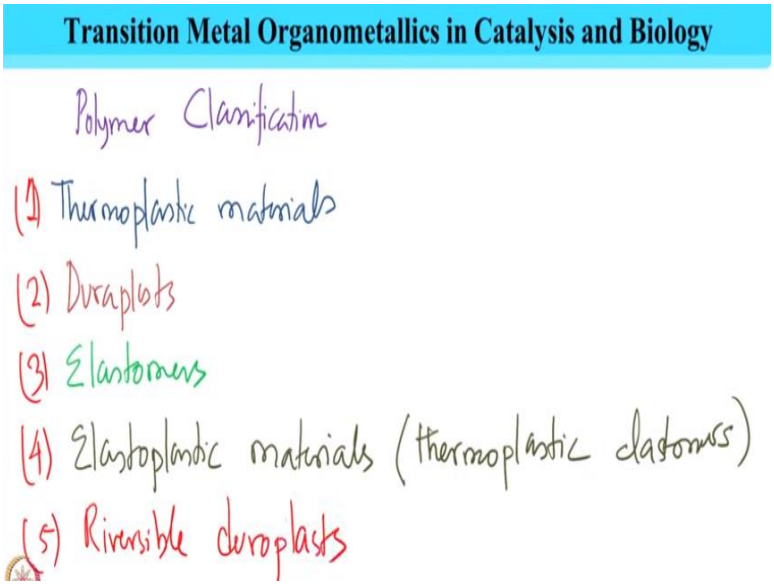

So in this context in our previous class we have looked into 3 types of polymers so the first that we looked into discussed that the thermo plastic materials these are the materials they exhibit stability under short terms strain however upon warning they transform into a plastic that means they easily deformed and they retain the deformed shape then we had discussed about dura plastic materials and these are materials which maintain their shape upon extended period of strain or high temperatures they are usually formed by cross linking pre-polymers by heating and this cross linking formation is usually reversible and this cross linking is very fine messed and they have low segmental in the mobility and as the result across linking dura plastic rarely crystalline.

In our earlier class we had also discussed another new type called elastomers and these elastomers are the materials which can be easily deformed however once the deformed stress is removed they go back to their original shape. So that means they have a memory of their initial shape even though they are deformed once the deformation stress is gone they go back to the original state.

So these are elastic materials are rather properly known as elastomers they also are made up of cross linking of pre-polymers this pre-polymers however long chain and they have wide meshed. So these are the 3 materials that we had discussed in the previous class and today we are going to start with the forth one which are called elasto-plastic material or thermo plastic elastomers. The fourth one that is going to be talking about are elasto plastic materials or thermo plastic elastomers.

Along the same line we are going to describe another form of polymer which are called reversible duraplasts. So today we are going to focus on these 2 polymers number 4 and 5 which is elastoplastic material and reversible duraplasts before we move on various classification of poly ethylene polymer.

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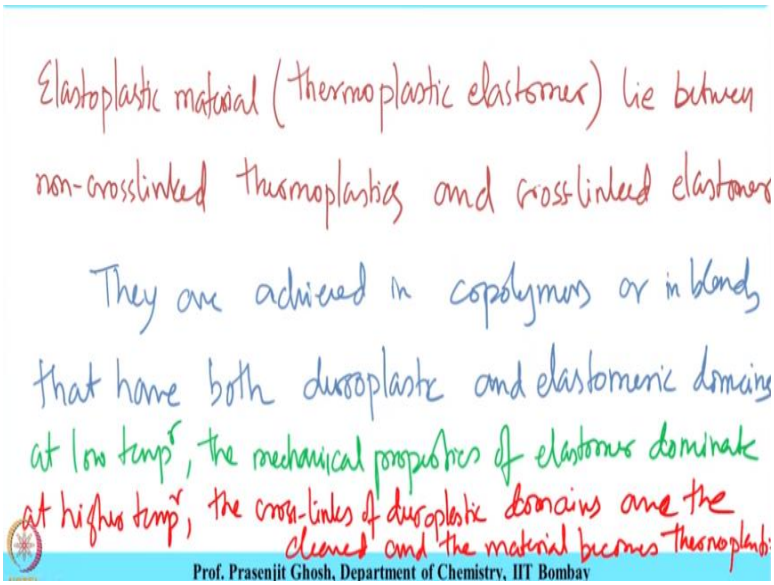

So let us begin by discussing elasto plastic material or thermo plastic elastomers or thermo plastic elastomers and these lies somewhere between non cross linked thermoplastic and so these polymer lie in between non cross link thermo plastics which we are discussed earlier and cross linked elastomers. And these is achieved by in copolymers or in blends they are usually achieved in copolymers of 2 different hypes in the same chain or in blends that as both duraplastic as well elastomeric domains that have both duraplastic and elastomeric domains at this work.

In such a way that in low temperature the mechanical properties of elastomers content dominate of elastomers dominate and that they have however at higher temperature the crosslinks of duraplastics domains are cleaved of dura domains are cleaved and are cleaved and the material becomes thermo plastic. So this is kind of interesting that these elastomeric material are thermo plastic elastomers are actually lie in between thermo plastics and cross linked non cross linked thermoplastic and cross linked elastomers and they usually are synthesized by or their achieved in a copolymers or in blends that have both duraplastic and elastomeric domains.

At low temperature the mechanical properties of the elastomer dominate whereas at high temperature the cross linked of duraplastic materials domain are cleaned and as a material becomes thermoplastics behave as a thermoplastic materials. So this is kind of interesting classification of new kind of polymeric material. The last in this discussion before we move into polyethylene is these that of reversible duraplast.

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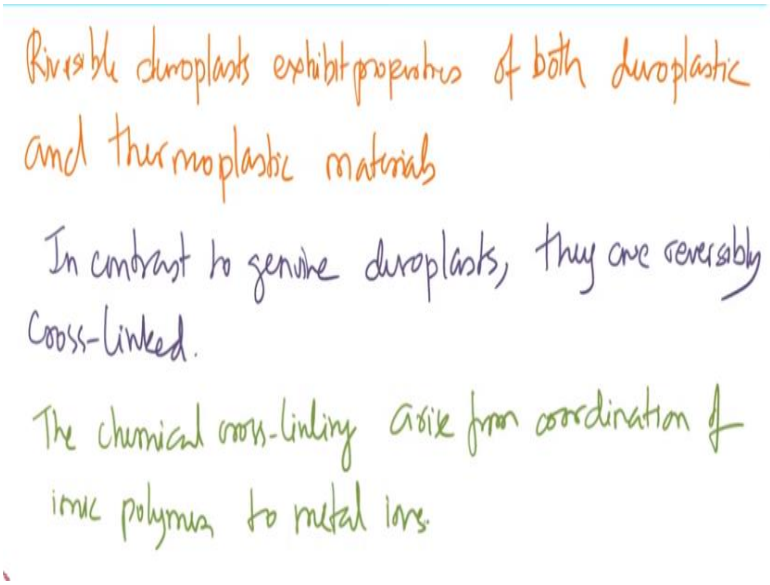

Now reversible dura plastic are exhibit properties which are both dura plastic and thermo plastic materials of both dura plastic and thermo plastic materials. And their primary difference between dura plasts is unlike genuine duroplast they are reversible cross link in contrast to genuine duraplasts they are reversibly cross linked and you know in this case usually chemical cross linked is often a result of coordination of iconic polymers to metal ions.

So these are not like cross linked where there is a overlap orbitals to make a bond so these are mainly of ionic cross link type the chemical cross linking arise from co-ordination of ionic polymers to metal ions. And so this is unlike the chemical cross linking which involves chemical bond break a cleavage this is more like a coordination bond between ionic polymer and metal ion which gets reversibly a cleaved during is application purpose.

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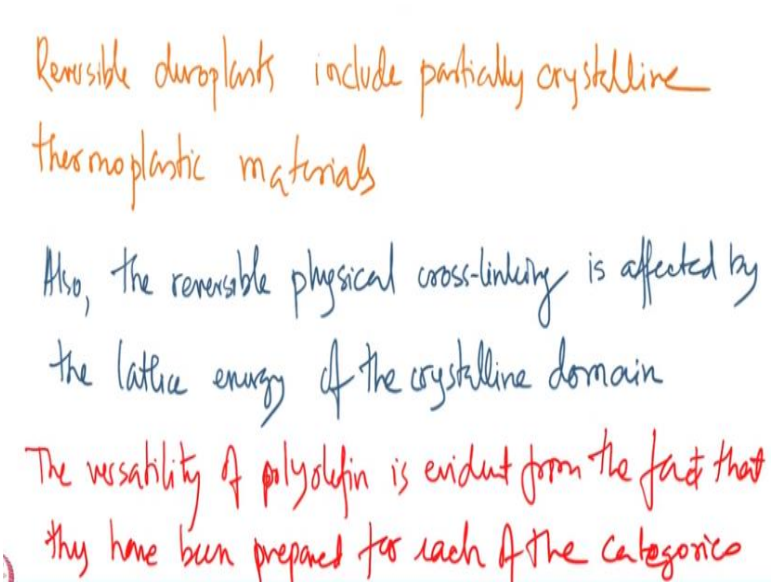

So the other properties of reversible duraplasts are include a partially crystalline thermoplastic materials and also the reversible physical linking cross linking also the reversible physical cross linking is affected by lattice energy of crystalline domain. Now these is a important that this reversible physical cross linking is affected by lattice energy as well which sort of points to the fact that non covalent interaction are also place a important role in this material which are reversible duraplasts.

Now so far we have discussed 5 classes of materials starting from thermoplastic, duraplasts, elastomers, elastoplastic materials and reversible duraplasts based on the type of applications and the type of the their material properties. Now with regards to poly olefin's the versatility of poly olefin's can be engaged by the fact that there are poly olefin's for each of these categories have been prepared and that is why they are so very important.

So the versatility about poly olefin's is evident from the fact that poly olefin's that they have been prepared for each of the categories mentioned above. So that shows how important this poly olefin are. Now with these having defined what are the categories of poly olefin classifications of poly olefin's we are going to bit more details and look into the type of classification that exit for poly ethylene.

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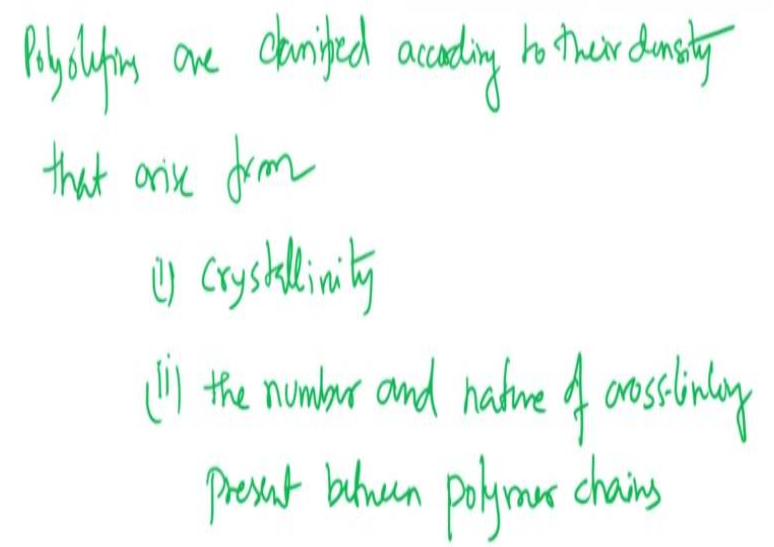

So poly olefin's are classified according to their density that arise from nature of crystalline extent of crystallinity then the number and nature of cross linking present between polymer chains. Poly olefin's are classified according to the density and this is something that arrives from crystallinity as well as number of nature of cross linking present between polymer chains. Now based on these we are going to now look into various classification of poly ethylene which is kind of important from our prospective.

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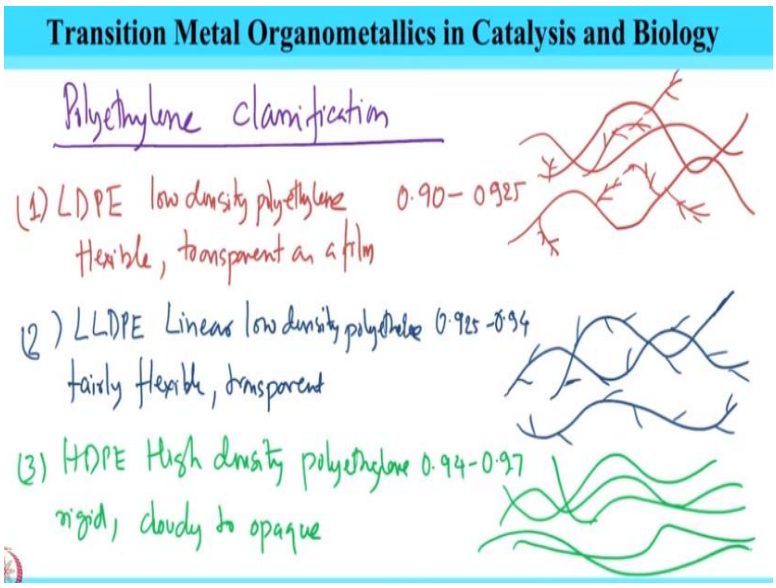

Now poly ethylene's are usually classified into 3 types the first being LDPE so this is called low density poly ethylene they are usually flexible materials and transparent as a film. Their density various from 0.90 to 0.925 and their property is that they would have long chains with branches

small branches and the branch chain will have smaller branches as is shown here also over here the branch side chain will have branches and these are called low density pol ethylene.

The next variation is called LLDPE these are called linear low density poly ethylene their also fairly flexible transparent and their density would vary from 0.925 to 0.94 and they would also have branches on the main chain their side branch is less. So the mainly have branches in the main chain so that is why they are called linear low density poly ethylene and the third of this type are called HDPE or high density polyethylene and they would vary from 94 to 0.97 their usually rigid and cloudy to even opaque.

And they are just polymer chains without any branching as is shown over here so with these we come to the end of today's discussion where we have looked into various the remaining 2 variety of polymer classification including elastomeric plastic material or thermo plastic elastomers and reversible dura plasts and finishing that we looked into the classification of polyethylene which are of mainly 3 types linear load first is LDPE low density polyethylene that has a density of around 0.90 to 0.925 and they are long chain polymers with branching of the side.

Then we have linear low density polyethylene where density is from 0.9252 to 0.94 their also flexible and transparent material. Here also these are very short branches around the main chain but not very big chain branches. And last we had this high density poly ethylene having density from 0.94 to 0.97 and these are little and cloudy to opaque materials which does have at all any branching.

So with these we come to the end of today's discussion on poly olefin classification we are going to look into this polymer classification bit more detail when we meet next for ethylene as well as for poly propylene and I once again thank you being with me in this class and we would have more interesting discussion about this poly olefin classification when you take up the topic in the next class till then good bye and thank you.