Sustainability Through Green Manufacturing Systems: An Applied Approach

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Lecture - 26
Laboratory demonstration

Good morning, welcome to our first lab demonstration session here we are here in SMC lab of IIT, Kanpur, India. So, here we have a setup in which we will do grinding on the tanium worksheet work piece here, we have already like given the details what are work piece specifications what are wheel specifications other things.

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This work piece has 25 mm of width and 160 mm length, discipline machine with this are wheel that is aluminum abrasive wheel.

So, we have various instruments that would record certain responses that which will use for our final like optimization with respect to green parameters.

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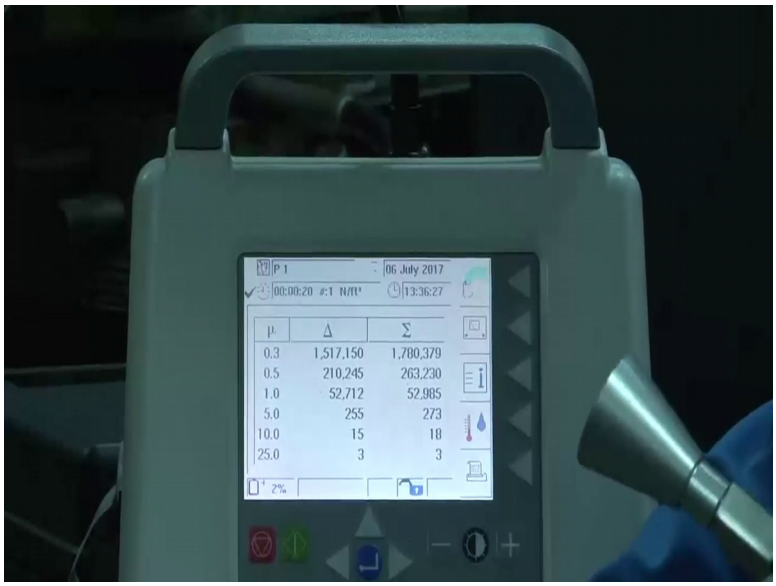

This is our aerosol air particle collector this is a laser air particle collector we have already does given some information on this one this will collect the data it is has 6 channels 0.3, 0.5, 1.0, 5.0, 10.0 and 25.0 microns micro meter of particle size. In this case we have just recorded this ambient room aerosol or what you say ambient air particle size. So, it has just bought up given this specific rating here 0.3 microns these are the number of particles of 0.3 microns and thus next we have 0.5 micron size particles are these are the numbers, smaller the particle size is more be the number of particles. So, and it this is the total number of particles that we have obtained till now.

This is one thing; this sound meter would let record this sound that is the peek and average sound that is that occurs during the machining.

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So, see the sound here coming is this is a minute machining shop the regular sound it is of the order of 70, when I speak it reaches up to 86, I actually this is a workshop, my volume is quiet high, it is coming 85 decibels here. So, you can see the sound raise raised to even 107 decibels here and in the room, we will be as already talk that in the office it kind of the like a environment. We have 55 decibel is the acceptable sound level, this will record that incase the peak sounds the peak like a inputs we like receive here should be less than 10 per day, this is the that whatever recommendable limit is there when industry in specifically in India.

This is another instrument which record sound, these are for our green parameters which we have like chosen as green parameters to the regarding energy that is basically we like in green the everything when we want optimize with respect to energy where even to reduce the energy or minimize the energy input in machining specific this specific work piece here, this will be kind of a like a kind of a sample or organic example experiment here.

Energy would be recorded using this dynamo meter, this dynamo meter called record the force that will further converted into specific energy this dynamiter is covered with actually these sheets, as the aerosols and the other particles do not enter the machine and just how like deteriorate machine components of work piece some other things, etcetera.

This would record this is connected with this cable to our control unit here for this is our control unit.

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This is lab view software for this is connected here; in this case the force is being transferred into electrical signal that is 1 Newton of force is given 1 volte energy that is for the calibrative we have lab view software here.

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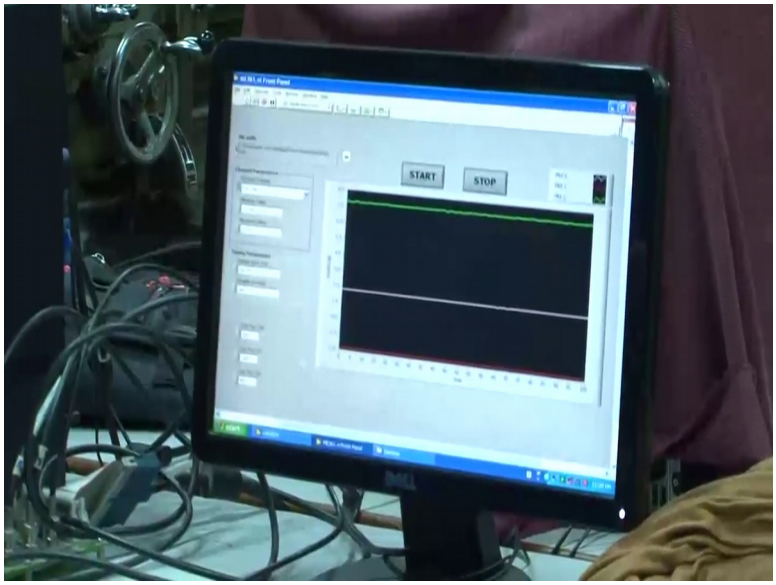

When we do machining these are the force effects we have the force in x, y and z direction, in this case z is our normal force and y is our tangential force x direction we

would not have any force here. These 2 lines which is which represent our z and y directions would give us the normal and tangential forces tangential forces is mainly responsible for machining, that will use, how to operate these things all these things are things work and we will just come up with that.

So, before starting experiments we need to like calibrate everything and make it make sure that we have the equipment, as their known voice factors note this sound noise the other noise factors which externally affect which cannot be controlled otherwise. So, for that this dynamiter is calibrated, as we have we converted that 1 Newton to 1 volte and some correction factors are put there in our lab view software and this wheel would be dressed and everything sound meter is like calibrated and the aerosol pro like collector everything is this wheel meter just will show whole dressing is done here. Here we have diamond dresser here which is given 10 micrometer input like a feed here and it would do machining. We will just see how the dressing does he is Mister Athul who would help us in that.

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Let us start up; you will start, see he has already given 10 micron feed here we called it feed actually this is the like movement what is up side and he is a now bringing the wheel on this side that is the transfers movement, as the wheel is dressed. This is like we will not run only one here like we will not run only once it will be multiple runs and this is accommended by the wheel manufacture the grinding wheel manufacture he recommends that these are the various parameters.

Once he has done the dressing now we are just touching this wheel with work piece, what is it is just in a contact after that we will give some specific depth of cut and do machining, see when wheel touch we will observe a spark here, that we see is the wheel is touched here ready now which we have here is ample setup. This is why are we are here like this is the main thing we are doing here we are just gone to demonstrate; how came machining is like conducted here.

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In this, we have this nozzle actually this nozzle is all fixed in our setup excuse me I will show that, we removed just attachment because we have we were to dress the machine this wheel here, this will again fixed is nozzle is kept at a 100 mm distance from our work piece like tool work piece contact work point and this is a setup here.

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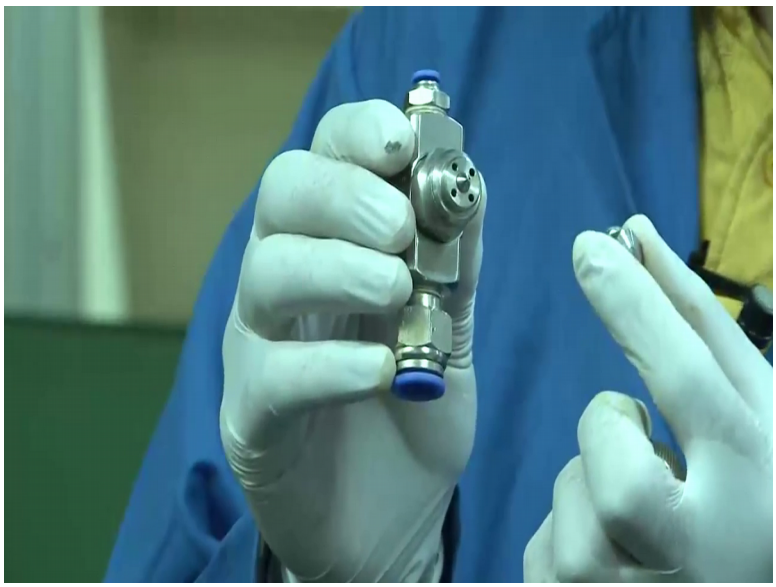

We have already told you that this nozzle this is a single kind of a nozzle here this nozzle has air and liquid inputs here from the 2 valves and we get the like mixture a atomizing here. In this case this is our round cap thus kind of spray would be have; would had be

round that we were discussed. This is a round cap we also have flat cap in some other things for this these are the 4 holes from which the air would be coming and there is a rfs from which liquid will be coming. This is an external mixing kind of a nozzle, in this case I put this air cap here and lock it with as screw have a locked nut here and the other body parts already discussed and it is already fixed here. This has been calibrated so as we have we get stream line flow that, as machining is done a like in good way.

We have this pressure gauges and this is the this is the line which is giving air right and this case we having liquid and we have use a separate setup here what happens what it was allowed that we gen if we colabe directly air and liquid here this flow was not continuous it was intermittent flow, intermittent flow that it will becoming flow like flow coming and stopping intermittently.

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So, for tool like a counter that we made an attachment and we made this close chamber we put a fluid here and these are pressure gauges and air is pressurized to obtain for this is the liquid going out towards the nozzle. This is a air is less pressurizing this one and the liquid and this air pressure towards the nozzle is controlled in such a way that we get continuous flow, continuous like a spray here right, we will fix this attachment and do machining.

What we see here in this air particle collapter; this is Lasair 2 model we have just switch it on and see it is giving 10 seconds of we initial we have listed time the time like a just

prepare to record then recording starts here. In every second the pulse rate is one second here in every seconds it is recording some data here for this data is then like obtain in like a pen drive or some other like way we could we could even going this straightly to the computer and that is used to find out the total like micrograms per meter cube of aerosols or air particles while doing machining.

We will record the data and this has been synchronized with our lab view software as well that while we record the data in the specific time when machining is happening and then the machining is happening some aerosols would be like coming out and we will the record the data recorded do the; obviously, be high, what are the specific data points data like values coming that we will discuss.

When we stop it here it will even print the average value of this time, it will even print this average value like in this time.

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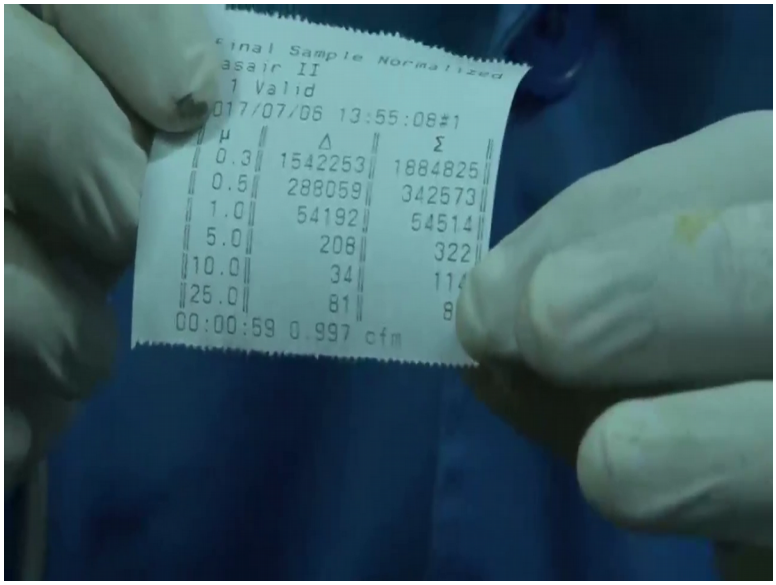

This specific time it has for 59 seconds it has recorded point 0.3, 0.5, 1.0, 5, 10 and 25 micrometer of particles and these are the counts got it thank you.

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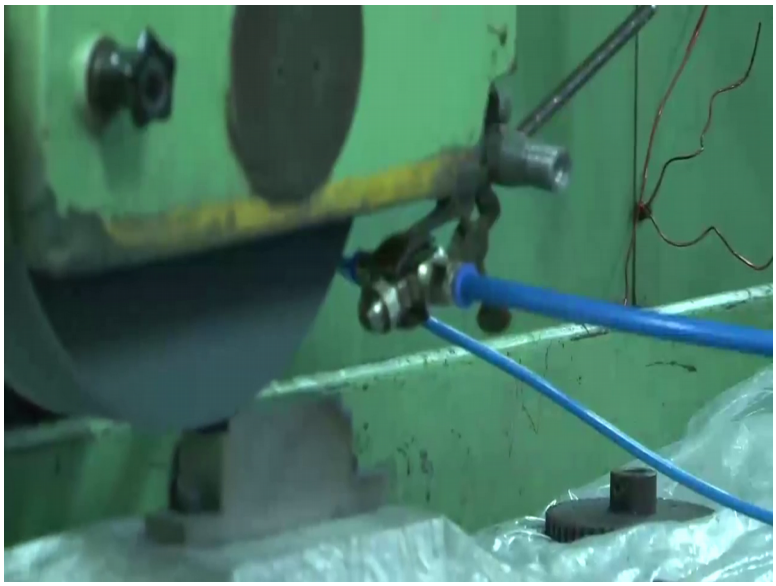

We will we have now fix this attachment here, as to keep this distance specified distance have to the set. Now I have fixed on the compressor and the it is giving see it is giving the spray here the spray rate here is 100 milliliter per hour, is one and in flood, we have of the order of 5 liters per minute is 100 milliliter per hour and see the sprays also the flow it also continuous it is in line flow it will specifically at the point stop work is that like machine is point here.

These instruments these actually I am just a take kind of makes if kind of where element here, these instruments are generally fixed not generally fixed at a distance. So, as it represent human nose and a human ear, so example I am hear this distance is identified as 500 millimeter here right, I we will just hold it here and record both the things that while machining what is the sound value how it is changing and I will just switch on the air particle counter it will be record that. We could start the machining and that data would be recording in our lab view software we can start now.

We have we have given 6 micro meter of depth of cut and table speed here is 10 meter per minute in this machine we have like minimum that is this least count for depth of cut is 0.2 that is of 2 micro meters here.

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Specifically and the table speed here is we have discreet table speeds available here 2.5 10 15 20 and 25 meter per minute we cannot take continuously we cannot have (Refer Time: 17:34) 2.6 like it meter per minute speed, this is a conventional machine this was a see and see machine.

This specific juncture we have 5 meter per minute of speed table speed now we start the machining we look this spark in the forward and backward stroke here, what we did here we did the machining which is one machining pass has been done. Now it was forward and backward stroke you might have observed this park this park that occurred during our like machining here. So, this actually the stroke that is taken into a count how calculation is the forward stroke only because that is very new stroke backward stroke is just taken for like some back and calculations that is it come in for raise the pattern similar or not.

You might have observed the values that were during a machining time were when the machine is on this is a average value it was of the order of 80 to 85 when I am speaking also this value is coming. It is average value is not of the like not of concern here what is important is the peak value and we reach that peak value that may hinder in the long run to like the operator here.

These 2 parameters are for controlling we work environment work environment that is the how it effects the human operator here, we cannot just control, we just monitor this

thing whatever we do machining remains within a specified like specified levels which are recommended by various bodies.

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This data is recorded in our machine in aerosol laser and this is recorded here, this data would be used further for monitoring this one. I am on the interface this lab view software see we have we are running a second run here for the machining or these are the 2 strokes available the forward stroke and backward stroke for these are the forces which have been obtain, I just stop this here.

Now, we see only 2 forces obtained here this one is not changed this are normal and tangential force, will record will just obtain this data and I will just save this somewhere, as we have obtained 2 values here, 2 values of force is here this would be further recommended in this specific energy that is a energy per unit volume of material removal and that with respect to and then we will just find what is surface of that. I will further I will just tell the next sections that what how we are just reading and cleaning the data and how we just analyze the data to find final output.

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So, what we hear have, here is surface reference tester this is (Refer Time:21:14) S J 2 1 0 surface reference tester, in this case see the this screen is the upper bar is was red now it is turned to green when we just touched this stroke here with the like work piece surface just turn green now he has switched on the probe is moving and it is taking 5 samples here, 5 samples into 5 it in the third row here point of 0.8 mm. It has moved totally 0.8 to 5, 4 mm to 4 mm like distance and given total like of average Ra is this much also you have a just my have observed that it has given the graph as well here.

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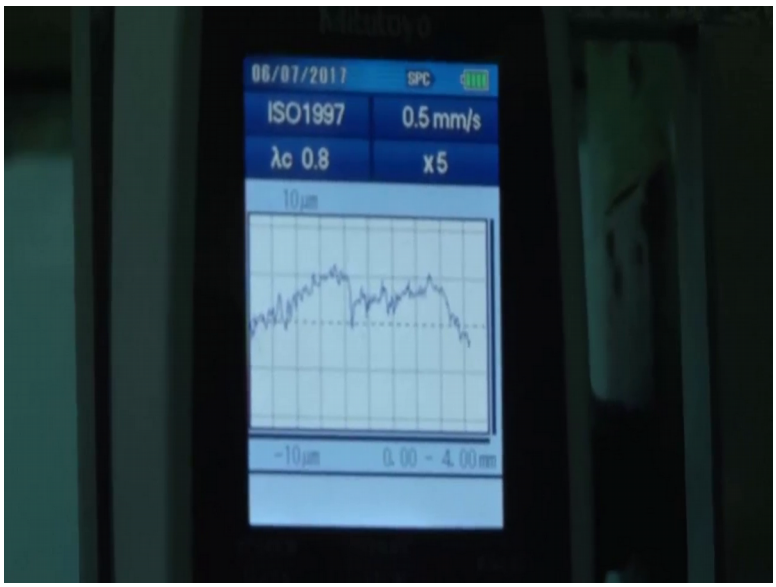

We again doing one experiment to show the graph how the graph is coming here, it has moved 0.8 mm into 5 and this is Ra coming 0.6 micro meter for one sample and we do not only take Ra once we take it is multiple locations here and one location we might do like number of replicates, as to find that their no noise levels here where it is 0.6 micro meter here.

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In different machine in treatments did a different like depth of cut and speed combinations we will might observe different Ra values and different force values as well, those would be used to finalize are final setup which gives best mix of this two.

This is used to find the surface stuffiness of the like this specific work piece which have machined here the reason to do grinding is to have surface of stuffiness good surface of the (Refer Time: 23:15) only, but have surface of stuffiness desired. In this case to the resource parameter and quality parameter, in resource parameter we can use force, energy or certain other things which are input cutting fluid and what have resources inputs are here.

In quality parameters one can choose the parameter which give us the quality of our work piece of machining for example, in this case we have taken surface stuffiness as the parameter. We can one can of other choose the wear tool wear or wheel wear etcetera those parameters (Refer Time: 23:46), this parameter will be taken here. So, we have

recorded this data we have done multiple experiments before and we will just give you how to analyze the data and find the final output with respect to gain.