

**NASA/JAXA Igniters Manufacturing Dialog--NASA STD 6001 Tests 1 and 4
 (procedure published in ISO 14624-1)**

Question	WSTF Answers
At JAXA, there is no order for the materials to be mixed. Do you follow a particular order?	No, however we do put all of the powder mix in a plastic bag and shake it up before we place it in the mixing bowl.
At JAXA, the mixture generates heat when the water is added to it. Is it normal to have heat generated from the mixture when the water is added to it?	Yes
We cool down the mixing bowl to remove the heat from mixture when the water is added to it. Do you cool down the mixture while mixing?	No
Chemical reaction of a mixture with water is written in WJI-800-0018A as follows: "As the sodium metasilicate absorbs the water, the mix will start to thicken and eventually achieve a dough like consistency. This could take 20-30 minutes depending on ambient conditions." (01-004.d MIXING THE IGNITER MIX WITH WATER) We add 60 ml in 30 min. How much water do you add in 30 min and does the chemical reaction start when water is added?	Most of the water has been added to the mixture within the first 30 minutes. However the mixture continues to mix for an additional period until all of the water is absorbed and the material becomes dough-like. An exothermic reaction is occurring while the water is being absorbed. Time can vary from when the water is added until the exothermic reaction begins. In the past, we left the powered mix in the open with no desiccant and noted that additional time was required before the exothermic reaction began. Therefore, I believe that the reaction time can be affected by whether or not the mixture has been left in a humid environment. (Note: We have not experimented with regard to the quantity of water required to initiate the exothermic reaction because we are not interested in the initiation only that it occurs and it cools off before we extrude the material.)
We drop 2ml/min of water constantly to the mixture. What is your speed of adding water?	Prior to introducing the powder mix, the bowl is slightly moistened; then we introduce the powder mix. We usually introduce ~ 70 ml of water in the beginning and as the water begins to absorb we add the rest as required, ~ 10 ml in 5 min increments, for a total of ~ 190 ml).
Does the speed of adding water affect the extruding process of igniters?	I believe that adding water slowly would make the mixture clumpy; we don't want too much time to elapse from the beginning until the mixture is completely wetted. Clumps would stay in the mixture making it more difficult to extrude, resulting in porous igniters.
We decide the total water quantity by touching the mixture. The mixture should feel soft and doughy. How do you decide when to stop adding water.	We usually add 190 to 200 ml of water. The procedure states to place 200 ml of water in a burette; this is usually the amount of water needed to end up with a smooth consistent mixture.
At JAXA, when the dropping speed is fast, a hard clump of mixture is formed in the bottom of the mixing bowl. In that case, we abandon the manufacture. Does a similar phenomenon occur with you?	We have not experienced this problem.

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Can the hard clump of mixture be used as igniters?	A hard clump of material could not be extruded in the WSTF extruder.
At JAXA it takes us ~ 100 min from the beginning of adding water to the beginning of extruding the mixture; i.e. adding water, mixing, kneading, and rest, if any. How long does it take you?	We have never really timed it, however we usually schedule 1 h for the mixing to take place and we tend to be on schedule.
At JAXA the humidity is 30-40 r.H. in winter and 40-50 r.H. in summer. Is it harder to make igniters when humidity is higher?	Yes: When the humidity is over 30 % we do not make igniters. We usually make igniters in the winter or early summer, before the rainy season begins.
Our mixture sometimes looks glossy, but other times it doesn't. An extrusion does not succeed with glossy mixtures; i.e. the surface of igniters does not feel smooth. When you stop adding water and/ mixing, does you mixture look glossy?	No: Our mixture usually looks dull.
We knead the mixture with the hand for two min after mixing. Do you knead the mixture?	We knead the mixture for a short period to ensure the removal of air; otherwise the extruder will spit out small chunks of igniter mix.
How do you knead the mixture?	We knead the mixture 2-3 times, with gloved hands, pulling it apart and bringing it back into a ball.
We knead the mixture for two min after mixing and then extrude. We do not have a certain amount of rest time after mixing and/or kneading.	As soon as the mixture is ready we immediately place it into the extruder and begin to extrude because if we wait the mixture will become hard as a rock and then we cannot extrude it.
Do you have the mixture rest for a certain amount of time after mixing and/or kneading?	No: It is immediately extruded.
We have successful extrusion; i.e. the surface of igniters feels smooth, when the mixture is glutinous and/or viscous.	Note: Our mixture is dull and soft.
Is your mixture glutinous and/or viscous before extruding?	No
We change the speed, with which we extrude the mixture, depending on the hardness of the mixture. Do you always extrude the mixture with the specific pressure or speed?	No: We also change the speed from beginning to end, however not by much.
We use a nozzle 3.2 mm in diameter. What size nozzle in diameter do you use?	The same.
We found igniters harder later in extrusion. Do you see any difference in the hardness of igniters between earlier and later extrusions?	No. We extrude the mixture very quickly (~10 min or less), including set-up time.
Our igniters sometimes look yellow. Do your igniters ever look colored, for example--yellow?	Our igniters did turn yellow in the past. We decided to place them in a dry desiccant instead of a ventilated area, when drying. As a result, the igniters turned off-white instead of yellow.
Do you have any comment why ours do so?	I suggest you look at your curing process and ensure you maintain the drying chamber at 15 % or less humidity.

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Many of our igniters have cracks. Do you ever find cracks on the surface of your igniters?	We have experienced igniter cracks during the extruding process; this may happen when our mixture is not wetted well. After a short extruding period the igniters stop cracking and become smooth.
Do you have any comment why ours do so?	The mix may be a little too dry for extruding.
Do you have any standards for the physical appearance of igniters from the manufacturing point of view, apart from NASA specifications?	No, we do not have standards for physical appearance apart from the NASA specification.
Do you ever decide not to use all or part of a batch because of their appearance?	No, if they meet the required specifications, they are accepted as a normal igniter.

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