**ACTIVITY: Sialons – Ian Brown video clips**

**Activity idea**

In this activity, students watch video clips of IRL research scientist Dr Ian Brown talking about sialons and then answer a series of graded questions related to the content.

By the end of this activity, students should be able to:

* explain what sialons are
* name the elements present in sialons
* describe in simple terms the difference between a sialon and an O-Sialon
* state some of the physical properties that characterise sialons
* list some of the challenges that researchers in this area of advanced ceramic research face.

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**Introduction/background**

We have several video clips of Dr Ian Brown, a senior research scientist from Industrial Research Limited (IRL) in Wellington. In these clips, Ian is talking about a group of new advanced ceramics called sialons, some of which, known as O-Sialons, have been developed by his team.

O-Sialons have excellent thermal resistance properties, and a company known as Pyrotek are now manufacturing refractories for use in the aluminium industry using this material. (Read the article [Developing O-Sialons](http://link.sciencelearn.org.nz/resources/1764-developing-o-sialons).)

Current research is looking at using O-Sialon materials in body armour.

The activity involves students firstly viewing the video clips, and then answering a series of graded questions related to the content.

**What you need**

* Access to these video clips featuring Dr Ian Brown talking about O-Sialons
	+ [Challenges of advanced ceramic research](http://link.sciencelearn.org.nz/videos/1067-challenges-of-advanced-ceramic-research)
	+ [O-Sialon research at IRL](http://link.sciencelearn.org.nz/videos/1055-o-sialon-research-at-irl)
	+ [What is sialon?](http://link.sciencelearn.org.nz/videos/1054-what-is-sialon)
* Copies of the student worksheet

**What to do**

1. Access the video clips featuring Dr Ian Brown
2. Have students watch the clips and complete the student worksheet.
3. Discuss the students’ responses.

**Student worksheet – Questions about sialons and Ian Brown**

***A. Facts and figures***

1. Who is Ian Brown?
2. What is a sialon?
3. Of the elements present in a sialon, which one is often not found in traditional ceramics?
4. List some of the physical properties that sialons show.
5. What temperatures are needed to effectively sinter the component materials into a sialon?
6. Give at least 3 challenges that Ian and his team face in small-scale laboratory sialon production.
7. In the development of O-Sialons, name the material that Ian and his team finally used as a binding agent.
8. The high temperature furnace shown in one of the clips has an upper operating temperature of what?
9. What is a ‘green body’?

***B. Analysis***

1. In one of the clips, an experimental mix of ingredients is put together and converted into an O-Sialon ceramic. In terms of upscaling this to an industrial level where it is required to produce tonnes of the ceramic, identify some of the difficulties that might be encountered.
2. Ian talks about the application of O-Sialons in the production of inserts for body armour. He states that the density of O-Sialon is 3g/cm3 compared to 4g/cm3 for the ceramic alumina. Calculate the mass of an A4 (21cm x 30 cm) sized slab of O-Sialon upper-body armour insert of thickness 2 cm. Given that you need protection front and back, what would the total mass of the upper-body armour inserts be?
3. In one of the video clips, Ian talks about the challenges his type of research encounters, for example, he talks about blending and firing. Explain what the challenges are in these 2 process operations.

***C. Find out more***

1. In the production of advanced ceramics, a process called ‘sintering’ is used. Explain what happens during the sintering process.
2. Most materials decompose, melt or lose their structural strength when heated to temperatures around 2,000°C. How, then, are high temperature furnaces like the one shown in the video clips constructed?
3. How could you demonstrate the principle of thermal shock resistance to your classmates? (Hint: Cold milk bottles and boiling water do not generally go well together.)
4. Silica is one of the key ingredients in the production of O-Sialons. How is this substance produced on the industrial scale?
5. What is meant by the term ‘oxidation resistance’?