

# ***Goodfellow***

*Your global partner  
for materials*



***IN THIS  
ISSUE...***

*Focus on Foil  
Manufacturing  
at Goodfellow*

*A Novel  
Aluminium  
Foam*

*New Ceramic  
Fastener Range  
Launched*

# Welcome . . .



It never ceases to amaze me how much an organisation can change over a 12 month period and Goodfellow is no exception. Many will recall the acquisition of a UK ceramics company a few years ago, which has now become the Ceramic and Glass Division of Goodfellow Cambridge. Our customers now have a single point of contact for any ceramic or glass item, as well as our metal, alloy and polymer products.

Our Chinese operation moved to larger offices earlier in the year and the process was started to open a Wholly Foreign Owned Enterprise (WFOE). This should be complete towards the end of 2012 when Goodfellow (Shanghai) Trading Co., Ltd. will open its doors for business. The Representative Office will close and our Chief Representative, John Jiang, will take over as General Manager of the new operation.

Another part of the Goodfellow Group which has moved facilities is our US operation, Goodfellow Corporation. We haven't moved far, just 10 miles or so to Coraopolis PA, which is close to Pittsburgh airport. The new facility is considerably larger than the one we occupied in Oakdale, and this will enable us to develop a substantial stock location in the USA; this will not only benefit our North American customers, but will also allow us to ship from Coraopolis to any of our customers wherever they may be in the world. Goodfellow

Corporation's local manager is Ginger Tracey, ably assisted by Rick LaMar. Both Ginger and Rick were instrumental in ensuring that the recent move went smoothly; my thanks to both of you.

As always, I welcome feedback, not only on this newsletter, but on any aspect of our dealings with you, our customer. My email address is **stephen.aldersley@goodfellow.com**; I look forward to hearing from you.

Best wishes,

**Stephen Aldersley**  
**Managing Director**



# Focus on Thin Foil Production at Goodfellow

Goodfellow is well known for its extensive range of thin metal foils, but how does Goodfellow manage to offer such a wide range of materials, some of which are impossible to source elsewhere?

The answer lies in Goodfellow's rolling department, where experienced rolling technicians are able to use their many years of experience to create some extremely thin foils by mechanical rolling.

Our rolling mills are more flexible than those of many prime manufacturers. Goodfellow rolling experts are able to alter production parameters in minutes rather than hours, for example allowing us to quickly switch from rolling 10 pieces of a thin, soft material such as 5 micron thick high-purity gold, to 5 pieces of a thicker, harder material such as 50 micron thick titanium.

## Annealing

Rolling hardens most metals, which can make them more difficult to deform or lead to cracking. Many metals therefore require annealing in our ovens during rolling.

## Some of our past rolling successes include:

- Gold and aluminium foil rolled down to 1 micron,



- used as heat shields in aerospace applications
- Rhodium foil rolled down to 25 microns, used in X-ray applications

Generally we roll down to about 0.5 or 1 micron, dependent on material, although some metals are either too soft or too hard to achieve these thicknesses using traditional rolling methods.

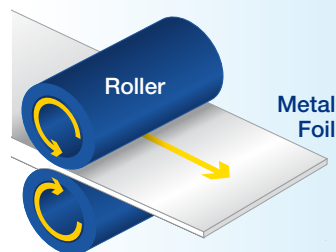
## Microfoils

Some customers require even thinner metals – from a few Ångströms to about 1 micron thick – and for these customers Goodfellow is able to supply microfoils. These are generally pure metals, deposited using a plasma vapour deposition process onto a substrate, generally a polymer. These foils are often used as X-ray filters, so we

tend to offer our microfoils on a polyethylene terephthalate (PET) substrate due to its X-ray transmission characteristics. Other substrates are possible on request.

*Goodfellow has been producing thin metal foils for over 30 years, and we welcome the opportunity to use our experience to help you in your research or production.*

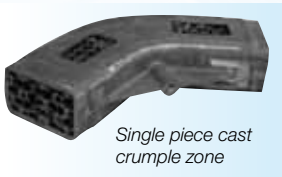
*Typical reductions in thickness are of the order of just a few percent for each pass*



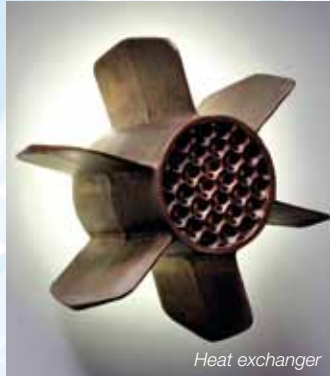
# A New Concept In Aluminium Foam

What do human bones, plant stems, marine sponges, corks and metal foams have in common? They are all complex materials made of honeycomb structures – structures which are both lightweight and durable.

A recent development in the area of honeycomb structures is a new, cost-effective aluminium foam with evenly-spaced, open pores. The foam is manufactured by the sand casting method, and as such the exact form of the foam can be determined before its manufacture, and is repeatable in series: each manufactured piece will be identical and will therefore have exactly the same behaviour.



For **impact absorption**, the advantage of this regular, reproducible aluminium foam product is that it can be designed with the end use in mind, making it possible to optimise the exact structure necessary to absorb the energy from an impact based on a specific application.

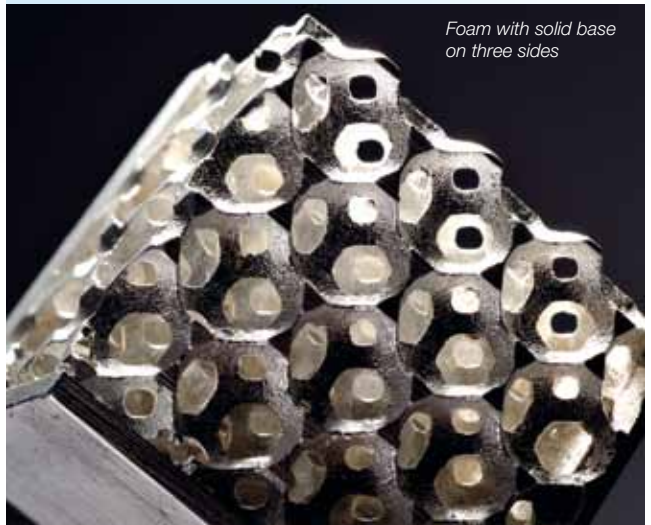


*Heat exchanger*

It is in **heat exchange** that this metal foam potentially has the most promise: its high porosity (80-90%) and its very high relative surface area of up to  $500 \text{ m}^2/\text{m}^3$  facilitate the movement of fluids and the recovery of heat, even at low speeds.

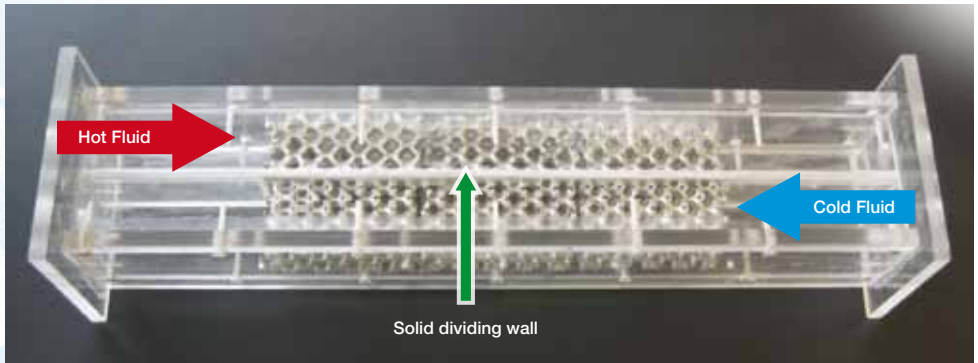
## So what is this “regular” foam?

The foam is made up of cells defined as regular tetrakaidecahedrons (polygons with 14 faces – 8 hexagonal and 6 square). Prototyping can be accomplished using standard pieces as stocked by Goodfellow, but for production pieces, the final shape can be moulded, reducing costs and eliminating the need for machining.



*Foam with solid base on three sides*

# Example of a Heat Exchanger\*



To test the exchange capacity of, and load losses generated by, this new foam, a single block of aluminium foam was cast with a cell size of 14mm and a solid wall in its centre. The heat exchanger was 300mm long, with a cross-section of 40x40mm. It was split by a central wall, creating a two-channel conduit. The foam was enclosed in an acrylic box to house instrumentation, and also to observe the fluid flow.

## Results of the study

Load losses follow the Forchheimer equation, with the following parameters:

$$-\frac{\partial P}{\partial x} = \frac{\mu}{K} \times U(x) + \beta \times \rho \times U^2(x)$$

$$K = 10^{-6}; \beta = 378$$

Thus, with  $Re = 2800$ , the loss amounted to 1.7 kPa/m with air and 1.4 kPa/ml with water ( $Re = 840$ ).

The counter-current with water was tested. The temperature difference between the cold and warm entries was 20°C. It was observed that  $h = 6800 \text{ W/m}^2/\text{K}$  for  $u = 0.06 \text{ m/s}$ , which corresponds to 1300 Watts.

## Conclusions

These first results are very encouraging; the loads generated by the losses are very low with a suitable exchange capacity. The foam parameters had not been optimised for the application, and it is assumed that this would give even more interesting results.

## Material availability

Goodfellow has concluded an agreement with the manufacturer of this new foam to offer standard sizes from stock. These are sheets 40mm x 100mm x 172mm with a cell size of 10mm. Sheets are stocked with one surface clad in a solid aluminium sheet to aid good contact in heat exchangers, for example. However, it is of course possible to specify other sizes or foams without a solid cladding on one surface.

\* We are grateful to F. Topin of the IUSTI Laboratory, France for allowing us to reproduce the heat exchanger experiment.

Please see our website at  
[www.goodfellow.com/gfnewsltr-en-oct2012.php](http://www.goodfellow.com/gfnewsltr-en-oct2012.php)  
 or contact us for further details on +44 (0)1480 424800.

# Ceramic Fasteners added to the Goodfellow Catalogue Range

Goodfellow is pleased to announce that a range of ceramic fasteners (nuts, bolts and washers) has recently been added to the standard range of products available from stock for quick delivery.

Ceramic fasteners offer a unique solution for applications where metal or plastic fasteners will not work. These applications often involve high temperature, high voltages, magnetism or harsh conditions which would corrode or wear away other materials within a short timescale.

The standard catalogue product range includes alumina hexagonal head bolts in metric sizes from M2 to M8, along with their matching nuts and washers. However, should a

different head style or special length be required, we can offer these as non-standard products. Imperial sizes and other materials such as zirconia, metals and polymers are also available on request.

The addition of these products will be of particular interest to customers working in scientific and industrial fields such as ultra-high vacuum, where the non-outgassing properties of the material are especially beneficial. Laboratories will also find applications for these fasteners due to their thermal stability.

These ceramic fasteners are all high-purity, fully dense and impervious. As with all Goodfellow products, further detailed technical information

can be provided to support their use. Please visit [www.goodfellow-ceramics.com/gfcnewsltr-en-oct2012.php](http://www.goodfellow-ceramics.com/gfcnewsltr-en-oct2012.php) for further information.

*The technical staff at our Ceramic and Glass Division is at your disposal to discuss the use of ceramic fasteners in your application and can be contacted on either +44 1480 424988 or [ceramic@goodfellow.com](mailto:ceramic@goodfellow.com)*



## NEW WEBSITE FOR THE GOODFELLOW CERAMIC AND GLASS DIVISION

Goodfellow Ceramic and Glass Division has launched a new website dedicated solely to ceramic and glass materials and products. The site was launched during September and features the addition of Spanish to complement the English, French, German and Italian language versions. The site describes the range of products and materials which the Division can supply, and provides many technical datasheets to download. Please visit [www.goodfellow-ceramics.com](http://www.goodfellow-ceramics.com) for more information.





# How we look after our customers



**Dan Bush,**  
**Production Manager**

[dan.bush@goodfellow.com](mailto:dan.bush@goodfellow.com)

Dan has been Goodfellow's production manager for over 4 years, and has more than 17 years of experience as a qualified Production and Precision Engineer within

the manufacturing and services field. Goodfellow's production areas contain rolling mills, annealing ovens, lathes, mills, press punches, grinding and polishing equipment, wire winding, powder sieves and swaging machines, as well as various cutting machines and a chemistry laboratory for depositing thin metal foils. With such a wide variety of equipment needing an array of tooling, techniques and specific setter and operator skills, Dan needs a wide skill set to manage his production staff. Dan started his career as an apprentice with a sub-

contract medical device manufacturer, and gained his production engineering qualifications there. Dan has also worked for companies manufacturing mechanical and electro-mechanical equipment, components and instrumentation.

Dan takes great pride in his staff and the Goodfellow production facilities, where we manufacture both standard catalogue items and custom components to customer drawings. His focus is to deliver quality products on time to all of our customers.



**Peter Dearlove,**  
**Quality System Manager**

[peter.dearlove@goodfellow.com](mailto:peter.dearlove@goodfellow.com)

Our customers often work in areas where product quality and batch traceability are critical. Goodfellow is proud to have recently celebrated 10 years of ISO9001 accreditation.

Working alongside Dan to ensure that our in-house production meets our customers' requirements, Peter is also responsible for maintaining and updating Goodfellow's Quality Management System (QMS). He ensures rigorous compliance to internal and external quality standards, whether Goodfellow is maintaining batch traceability on items bought in, processed in house and sent on to the customer, or ensuring that analyses carried out or commissioned by Goodfellow are appropriate to the product and its use.

With his background in engineering and tool making, as well as his qualifications and 38 years of experience in Quality Management, Peter is the ideal person to take Goodfellow forward to meet evolving quality standards. If you have particular quality requirements that you need your suppliers to follow, please do not hesitate to contact Peter. We are always happy to consider partnerships with our customers to help simplify your supply chain.

#### HEAD OFFICE

Goodfellow Cambridge Limited  
Ermine Business Park  
Huntingdon, PE29 6WR  
England

Tel: 0800 731 4653 (UK)  
or +44 1480 424 800  
Fax: 0800 328 7689 (UK)  
or +44 1480 424 900

[info@goodfellow.com](mailto:info@goodfellow.com)

---

#### FRANCE

Goodfellow SARL

Tél: 0800 917 241 (numéro vert)  
ou +44 1480 424 813  
Fax: 0800 917 313 (numéro vert)  
ou +44 1480 424 900

[france@goodfellow.com](mailto:france@goodfellow.com)  
[www.goodfellow.fr](http://www.goodfellow.fr)

---

Ceramic and Glass Division

Tel: 0800 151 3115 (UK)  
or +44 1480 424 888  
Fax: 0800 151 3225 (UK)  
or +44 1480 424 988

[ceramic@goodfellow.com](mailto:ceramic@goodfellow.com)  
[www.goodfellow-ceramics.com](http://www.goodfellow-ceramics.com)

---

#### GERMANY

Goodfellow GmbH

Tel: 0800 1000 579 (freecall)  
oder +44 1480 424 810  
Fax: 0800 1000 580 (freecall)  
oder +44 1480 424 900

[info@goodfellow.com](mailto:info@goodfellow.com)  
[www.goodfellow.com](http://www.goodfellow.com)

---

#### THE PEOPLE'S REPUBLIC OF CHINA

Goodfellow Cambridge Ltd  
Shanghai Representative Office

Tel: +86 21 6112 1560  
Fax: +86 21 6130 4901

[china@goodfellow.com](mailto:china@goodfellow.com)  
[www.goodfellow.cn](http://www.goodfellow.cn)

---

#### USA

Goodfellow Corporation

Tel: 1 800 821 2870 (USA)  
Fax: 1 800 283 2020 (USA)

[info@goodfellowusa.com](mailto:info@goodfellowusa.com)  
[www.goodfellowusa.com](http://www.goodfellowusa.com)

---

#### JAPAN

Goodfellow Cambridge Limited  
c/o Intralink Japan

Tel: +81 3 5579 9285  
Fax: +81 3 5579 9291

[info-jp@goodfellow.com](mailto:info-jp@goodfellow.com)  
[www.goodfellow-japan.jp](http://www.goodfellow-japan.jp)

---

For representatives in other territories, please consult our website at

***Goodfellow.com***