**Platform 3 – Isotope and Nuclear Science**

**Thermal engineering research advancing the development of more energy efficient home appliances with Fisher & Paykel Appliances**

**Alignment with the strategic intent of the Platform**

Advancing the development and use of energy efficient materials is pivotal to achieving a resilient, zero-carbon energy system. Rising to this challenge, we’re working with technology leaders to meet the changing needs of our communities, industries and government.

Through the NZ Product Accelerator we’re working in partnership with Fisher & Paykel Appliances to bridge the gap between research and market application. This valuable relationship helps us prioritise our research efforts and inform practical science solutions that are useful, usable and used by industry and consumers.

**The need for SSIF investment**

New Zealand manufacturing industries generally have difficulty executing in-house the experimentation and can lack the research base needed to develop new materials. SSIF investment in materials research and capability development through the Materials for a Low-Carbon Future (MLCF) programme fills an important gap between materials science and technological application.

The research aims to develop both strong partnerships and the enabling technologies to increase use of renewable energy and drive greater energy efficiencies, benefitting both industrial and domestic consumers. The research will also result in new processes and products which will drive broader economic growth through increased exports and licencing of both New Zealand-designed and made products.

**The research**

We are leading several different streams of work with Fisher & Paykel Appliances which seek to reduce energy consumption and lifecycle greenhouse gas emissions. We’re investigating the fundamentals of heat transfer and exploring the application of those fundamentals to temperature-controlled appliances.

The MLCF programme is applying physical and chemical techniques to modify the surface properties of materials to develop novel new technologies and materials for energy transfer and storage. A key measure of success is the level of industry engagement in new R&D projects developed in the programme.

There were two research directions that underpinned the Fisher & Paykel project:

* **Surface science and thermal devices research** ‒ focused on improving energy efficiency by investigating the formation of ice on metal surfaces and its impact on heat transfer.
* **Thermoelectric materials research** ‒ aimed at developing new energy transfer technologies from new knowledge of the effects of the molecular structure of materials on their electrical and heat conductivity.

**Results**

In surface science we treated conventional heat transfer materials – aluminium and stainless steel – by ion beam implantation to modify their surface structure. We were able to develop stainless steel that ice did not readily stick to and aluminium that changed the way frost formed on it, thereby resulting in higher thermal conductivity. In both cases the potential benefit from using these modified materials in processes and appliances is an increase in energy efficiency.

Our thermoelectric research has advanced understanding of the transparent copper iodide thermoelectric material. The research has shown how the properties of this material can be tuned through the addition of tellurium.

**Collaboration and funding partners**

Drawing on our robust industry communication and fundamental knowledge, GNS Science provided the most compelling research proposal to Fisher & Paykel Appliances. In February 2023 we started a $700,000 per annum advanced insulation research programme, fully funded by Fisher & Paykel Appliances. This programme was renewed for a second year in February 2024 based on successful delivery of the first-year programme.

In collaboration with Fisher & Paykel Appliances we are now developing new insulation materials and systems. The combination of industry and research institute has created a fast-paced research programme that is delivering results. We have recently produced a new insulation material designed to fit into appliance manufacturing systems that is meeting performance targets. We are on track to be producing this material at full appliance scale by the end of 2024 and plan to make full size appliance prototypes in 2025.

Fisher & Paykel Appliances Executive VP CarbonZero Transition and R&D, Kane Alwar said *“the project is a great example of the potential to extend F&P’s appliance knowledge and engineering innovation with GNS’ fundamental materials science expertise”.*

The collaboration has received positive media coverage: <https://www.odt.co.nz/features/sponsored-content/sorec/innovate-collaborate-transform-nz-product-accelerator-and-fisher>

**Who it helps and how**

Fisher & Paykel Appliances is part of Haier Group which can quickly roll out new materials innovations to around 20% of global appliance production and more than 50% of appliance sales in New Zealand. Appliance users will benefit from reduced energy consumption and running costs, while also reducing greenhouse gas emissions.

In addition to delivering research impact to Fisher & Paykel Appliances, we are seeing a virtuous cycle developing. The programme is feeding new fundamental materials research programmes in GNS Science and leading into other industrial applications. There is strong interest, for example, in cryogenic applications from Fabrum, a Christchurch-based world leader in the design and manufacture of technologies for the superconducting industry and other cryogenic applications.