



C-Tech Innovation
...advantage through technology

*Problems cannot be solved
by the same level of thinking
that created them.*

Albert Einstein

Our Philosophy

Innovation is the key to long term business success. It is now widely accepted that companies need to innovate in order to survive, let alone prosper, in an increasingly competitive global environment.

C-Tech Innovation is a leading innovation management and technology development company. Our business is innovation. We've been helping industry, universities, government bodies and non-governmental organisations to benefit and grow through innovation for the last 40 years.

Here at C-Tech, we believe that the key to successful product and process development is to embed a culture of creative and innovative thinking throughout an organisation. Then, through the application of multidisciplinary teams with diverse thinking styles, some truly unique solutions can be realised.

Our many strengths include project and programme management, research and development, technical due diligence, market and technical awareness, IP exploitation, multidisciplinary consultancy and innovation training.

We have a vast experience of technology development in the creation of new products and processes, the implementation of novel technologies, contract and collaborative research, technology transfer and commercialisation.

Our workforce is highly qualified, skilled and diverse - one which thrives on new and unique challenges. We have our own laboratories and workshops at our facility near Chester in the North West of England. This unique combination enables us to provide a flexible, tailored and, above all, confidential service, taking projects from concept, through design, to construction and commercialisation, all in-house.

**Contact us to find out how you too can gain
...advantage through technology.**



Innovation Management

Innovation is our lifeblood. We are a leader in the provision, delivery and management of innovation consultancy.

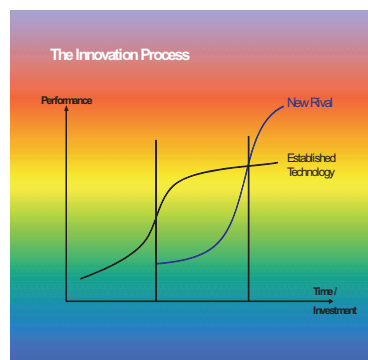
We have a strong reputation in **Programme Management** services including the delivery of often complex regional and national innovation support programmes. Through our involvement and leadership of research projects, we are at the forefront of technology innovation, and have developed strong working relationships with both academic and commercial organisations alike. We have an impressive track record in winning, contributing to and managing regional, national and international projects and programmes, for organisations such as Regional Development Agencies and their sector specific cluster groups, the UK Government and the European Union.

Our success in the management of many individual and collaborative research projects has led us to offer technology **Project Management** as a bespoke service. We can help you to manage and deliver your research and development projects, whether funded internally or externally.

Through our leading roles in the delivery of regional and national programmes we have developed a team of skilled **Knowledge and Technology Transfer** specialists. They can visit you to understand your issues and challenges, as well as identifying areas to address and prioritising your action plans.

We can also help you with your **Innovation Strategy Development**, highlighting steps that need to be taken to embed an innovative and enabling culture into your organisation. Not only that, we can help you to embrace innovative and creative thinking in the first place, turning your strategy into action. We can ensure that the results of innovation are captured and transformed into real tangible long term benefits.

We are convinced that innovation lies at the heart of business sustainability and development. So much so, that we have now developed a series of short, interactive **Innovation and Creativity Training Workshops**, designed to encourage and embrace innovative, creative thinking in your organisation.



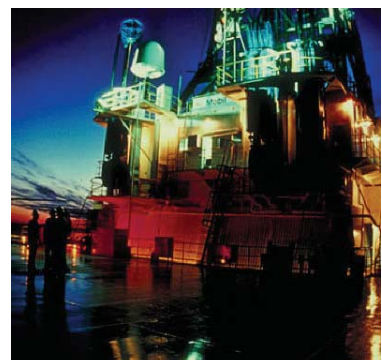
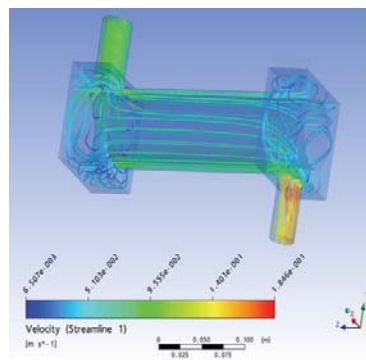
We can also help to provide a clear long term view of your technology potential, guide you through the steps necessary to overcome your immediate challenges and maximise your opportunities via our **Technology Road-Mapping** service.

We provide a robust and confidential **Technology Due Diligence** service, including assessments of technology strengths, the intellectual property position and the overall commercialisation proposition – of vital importance to potential investors and technology developers seeking an objective view and technology assessment.

Our in-house **Product and Process Design** capability enables us to take ideas from concept right through to reality. This includes prototyping, scale-up, pre-production and commercialisation stages – we can help you every step of the way. Our own internal design team ensures total confidentiality - key when you are trying to stay one step ahead of the competition.

As well as performing a great deal of our own research, we also offer a confidential contract **Research and Development Service**. Generally on a one to one basis, this allows our customers to concentrate on day to day business activities whilst we tackle the R&D challenges, in the true mode of **Open Innovation**.

We are also a major participant in collaborative research at regional, national, European and International level, and have met with much success under a variety of schemes both individually and as a partner. We can help you to further your specific priorities, helping you assemble and write your proposal and then work with you to develop your project. We have knowledge of funding available from Government and financial institutions which will enable you to support new product and process development.



Research and Technology Development

We are driving the development of technologies that will form the cornerstone of tomorrow's society- from novel energy and environmental technology through to innovative medical devices.

Thermal Process Engineering

We are a leader in the development of novel thermal processing solutions for manufacturing, commercial and domestic applications, including processes for heating solids, liquids and gases. We can help improve efficiencies and product quality, shorten heating cycles, and reduce energy requirements. Applications are diverse, and include drying, firing, curing, defrosting, cooking, sterilising and pasteurising. Many applications, where more traditional heating methods are currently used, can benefit from our expertise and knowledge.

Microwave, Microwave Assist and Radio Frequency can provide processing benefits not seen when using traditional sources such as radiant heat. More uniform heating, faster processing times and improved product quality can often result, leading to reduced emissions, lower processing temperatures and potentially novel material properties. With the heat being delivered directly into the body of the material being heated, heat transfer from the material surface is reduced. Successful applications have been found in the processing of food, ceramics, plastics and rubber to name but a few.

Ohmic Heating can have significant benefits for the heating of fluids. Heat is generated directly within the material through the application of electric current, leading to a highly efficient and uniform heating method without creating internal temperature gradients. Ohmic heating has a wide range of uses including processes where the prevention of burning and fouling is a critical aspect.

C-Tech is also involved with other important heating technologies with industrial and commercial applications. These include **Infra-Red** which can also be used in heating, drying and curing applications, and **Rapid Induction Heating** which can achieve extremely high heating rates in metals, more efficiently than conventional induction techniques.



Nanomaterials

The creation of novel materials demands novel processing routes. We are now developing new materials with novel properties, through utilisation of our advanced processing technologies.

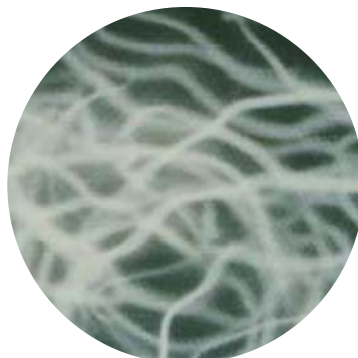
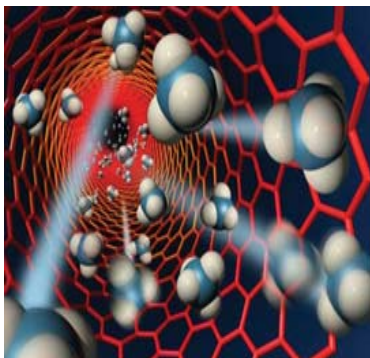
Our **Atmospheric Pressure, Non-Equilibrium Plasma (APNEP)** technology has already been used to produce novel nanoparticles ready for collection, or deposition as coatings. It can also be used to modify, degrease and clean a variety of surfaces and also to destroy Volatile Organic Compounds. Based around a microwave sustained plasma, a wide range of both simple and complex nanoparticles has been produced. The APNEP has also been used to apply various coatings, including the coating of nanoparticles with a range of nano-scale materials.

Our patented **Microwave Assisted Gas Firing (MAGF)** technology can be used to fire and sinter materials faster, and under more closely controlled conditions than previously achievable. At the same time it uses less energy and produces fewer emissions than many more traditional techniques. The technology produces a more even heating pattern, can process complex shapes much more easily than radiant heat alone, and enables preparation of materials with closely defined properties at the nano-scale.

We have also developed a **Biological Nanoprocessing** technique with far reaching applications, including the recovery of precious metals from roadside dust particles, and also solgel and electrochemical processes which act as highly controllable, low cost, deposition methods.

Medical Devices

A specific area of application for advanced materials is that of medical devices, where we have used our **APNEP** technology to develop new antimicrobial coatings for bone screws and pins. We have combined that with our sensors knowledge to develop breath sensing equipment for early stage detection of clinical illnesses.



Environmental Technology

Our environment is ever changing and becoming more precious. Legislation, corporate and collective responsibility and economics are encouraging us to think more carefully about resource efficiency and our concept of 'waste'. C-Tech has long been associated with environmentally beneficial technologies, including the development of both cleaner technologies and more efficient processing methods. Our work covers such diverse aspects as potable water treatment, solid and liquid waste treatment, material recovery, thermal waste treatment, energy from waste, aerobic and anaerobic digestion and renewable energy.

We have been developing **Electrochemical Treatment Systems** for many years and work with both ion selective membrane stacks and individual scale electrochemical reactors for the treatment of effluents and the removal of toxins, organics, and metals from waste streams.

Cleaner, greener and more efficient chemical reactions are often possible using **Microwave Chemistry**. However, although microwave chemistry has been in existence for many years, scale up has always represented a significant challenge. We have used our microwave expertise to scale up from discovery (milligram) to production (kilogram) scale, at elevated temperatures and pressures. We have developed both batch and continuous flow-through systems, representing a step change compared to previously available technology, and we are also developing solutions using ionic liquids.

The achievement of predictable and repeatable chemical reactions often depends upon the ability to deliver even heat distribution into the reaction. C-Tech's **Ohmic Heating Technology** provides such a solution as it is a true 'volumetric' heating technology. As there are no hot surfaces to create temperature gradients within the liquid being heated, temperature change can be controlled accurately with less need to mix the material being heated in order to achieve uniformity.

C-Tech specialises in developing streamlined **Life Cycle Analysis (LCA)** methodologies and techniques especially for SMEs and in research projects. We perform to ISO 14040/44 standard using both in-house methods and advanced software tools.



Novel Energy Technologies

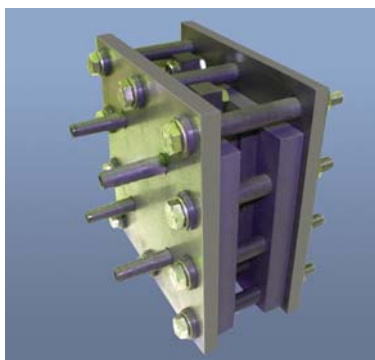
The efficient and responsible generation, harnessing, storage and use of energy is now a key challenge. We are involved in many important technological areas including **Bio Energy**, **Hydrogen Storage**, **Batteries**, **Fuel Cells** and **Energy Efficiency**.

We are working in the field of direct **Bio Energy** production of biological hydrogen from sources including biomass, incorporating pre-treatments to further enhance the reactions, thereby improving production efficiencies.

We are researching innovative physical processes which enhance the **Hydrogen Storage** behaviour of metals and alloys. This exciting process affects the materials in a way that is very different but also complimentary to research elsewhere, and has already been shown to accelerate both absorption and desorption kinetics of hydrogen into and out of the materials and also solid state diffusion within the material.

Battery technologies are amongst our established core competencies and we have a wide ranging expertise in all-soluble lead, cerium-zinc, vanadium, tribromide-polysulfide and sodium-sulphur systems. We can design and construct anything from small lab-scale cells to large demonstrator batteries, as well as perform **Computational Fluid Dynamics (CFD)** modelling of flow patterns and perform fundamental lab-based research.

Our experience in **Fuel Cell** research and development includes the design and construction of novel fuel cell stack arrangements, characterisation of high temperature membranes for PEM fuel cells, the use of bacteria to grow nanoparticles of precious metal catalysts, and technical due diligence relating to the market potential of microbial fuel cells.



Bio-processing

Bio-processing has real world application and enables step changes to be made in many manufacturing processes. Dramatic efficiency improvements can be made and a huge range of applications exists in environmental, chemical, health and pharmaceutical areas to name but a few.

We have many years experience in delivering bio-process development solutions to the food, pharmaceutical, speciality chemical and environmental industry sectors. Our expertise can assist at many stages of a project, from proof of principle, through process design, to pilot plant and beyond. Our knowledge spans microbiology, enzyme formulation, biocatalyst immobilisation, fermentation technology, process chemistry development and process engineering.

Sensors and Security

Issues of security and safety are of primary concern. We are investigating the development of **Remote Sensing and Detoxification Technologies** for a range of key applications, working extensively in the areas of security of indoor space and water supplies.

Our focus areas in sensing include advanced sol-gel surface preparations for sensing of contaminants in gas and waters and unique wireless sensors applicable for a wide range of measurement parameters, such as pressure, temperature, conductivity, pH, especially applicable in hazardous areas.

We are developing detoxification technologies to increase the rate of several reactions, also lowering the required energy input to improve efficiencies. This can help in the decontamination of gases, by using enhanced catalytic processes that use UV or plasma energy, greatly improving the detoxification efficiency.



Proof of the Pudding

New innovations come and go over time, but the process of creating them is not a chance occurrence and can be culturally embedded within an organisation.

At C-Tech we have gone back to basics. We have used our expertise and experience to build a successfully innovative business model. Using our technological strengths and networks, built through participation in both stand alone and collaborative research and development, we have developed our core competencies of technology development and management of the innovation process.

Our internal approach is no different to the way we work with our clients. We take an idea from first principles, and then develop it through applied research. Often generating new intellectual property, we undertake a rigorous assessment of the most appropriate route to market for the final product or process with a firm view of the commercialisation potential.

To date we have spun out new companies in such diverse areas as hydrogen storage technology, oily wastewater treatment, membrane bio-separations and domestic defrosting and cooking. We have also licensed thermal technologies such as our patented Microwave Assist Technology.

**Come and talk to us so we can help you to gain
...advantage through technology**



*He who will not apply new remedies
must expect new evils,
for time is the greatest innovator.*

Francis Bacon



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