

## Exo2 and the Benefits of Far Infrared Therapy

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*The benefits of Far Infrared (FIR) therapy have been long recognised in Eastern countries, particularly China and India. However, recent research has validated the wide-ranging medical claims of FIR, including increased blood flow, pain relief and boosted immune system.*

*Exo2 has developed an FIR material that can be applied to a wide range of products. This white paper discusses the effect FIR has on the body, what conditions can be assisted, Fabroc® material and the opportunities for Exo2.*

### What is Far Infrared (FIR) Energy?

The electromagnetic spectrum is the transfer of energy via electromagnetic radiation. The electromagnetic spectrum can be subdivided into regions according to its wavelength; these subsets include ultraviolet, infrared, microwave and radio frequency. Infrared (IFR) radiation wavelength falls between that of visible light and microwaves, and ranges from approximately 0.72 to 1,000 micron. The IFR region is itself divided into three subsets:

- Short-wave (near): 0.72 to 2 micron
- Medium-wave (middle): 2 to 4 micron
- Long-wave (far): 4 to 1000 micron

All bodies above absolute zero emit electromagnetic energy in some form. The sun produces 80% of its rays in the infrared spectrum. Our atmosphere allows infrared rays in the 7 to 14 micron ranges to reach the earth's surface, with peak output at 10 microns. Our bodies radiate infrared energy through the skin at 3 to 50 microns, with most output at 9.4 microns. Palms emit infrared energy from 8 to 14 microns and palm healing is an ancient Chinese tradition that has been using the healing properties of infrared rays for 3,000 years. The useful infrared region for therapeutic purposes is between 4 microns and 25 microns (see *Figure 1*).

### What effect do FIR rays have on the human body?

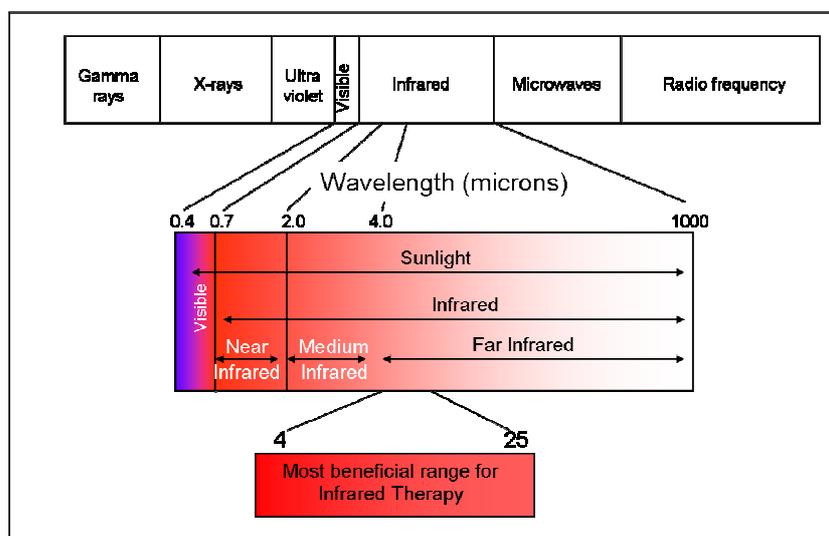
Unlike ordinary heat, which is mostly absorbed at

skin level and raises the skin temperature, FIR rays easily penetrate the skin. The natural resonant frequencies of water and organic substances are within the FIR range, which means that close to 93 percent of FIR rays that reach the skin are absorbed up to a depth of 4 centimetres. The electromagnetic energy travels in straight lines from the source, and it can be directed into specific patterns with the use of properly designed reflectors. It decreases in intensity as it travels outward from its source.

When infrared energy strikes an object (including tissue), it causes the surface electrons to excite and oscillate, which creates heat. This increased heat leads to vasodilation (**expansion of blood vessels and capillaries**), improved blood circulation, increased metabolism between blood and tissue, which

promotes faster tissue regeneration. Heating muscles improves blood flow.

The oscillation also reduces the ion bonds of the atoms that are holding together the molecules of water, resulting in a release of toxins.



**Figure 1 - The wavelength spectrum and its subsets**

Some studies have shown that there is improved angiogenesis (**growth of new blood vessels**) following repeated application of FIR;

Studies have also shown that FIR **improves endothelial function** of capillaries, arteries and veins by inhibiting neointimal hyperplasia (the uncontrolled proliferation of smooth muscle cells, which reduces the lumen of the blood vessels and compromises patency);

Unlike short wavelengths (such as X-Rays and gamma rays), which have a damaging effect on tissues, the effects of FIR rays are either biologically benign or beneficial.

### What are the health benefits of FIR?

FIR has been shown to have wide-ranging health benefits:-

**Provides effective pain relief** The application of heat has long been recognised as being effective for the relief of pain. In addition FIR may bring about an improvement by increasing blood flow and relieving spasms.

**Accelerates healing in soft tissue injury** FIR is being increasingly used for treatment of soft tissue injuries. Improving the blood flow to the site of injury can speed up the rate of recovery.

**Increased blood flow** Application of FIR can result in increased vasodilation even when there is no rise in core body temperature.

**Decreases joint stiffness** Subjective and active observation of joint stiffness has been shown to improve with application of FIR. Speculation is that both the joint and connective tissues benefit.

**Increases extensibility of collagen tissues** Applying FIR to tissues before stretching is particularly beneficial for ligaments, joint capsules, tendons and scar tissue. Not only does it reduce the risk of injury, but it also allows for greater extension than would otherwise be achieved.

**Reduces inflammation and oedema** FIR is a safe and effective treatment for inflammation. Increased peripheral circulation helps to reduce oedema, which helps reduce inflammation and associated pain.

**Reduces muscle spasms** Heat has long been used to treat muscle spasms, and FIR has additional advantages in that it can reduce inflammation and reduce pain.

**Enhances white blood cell function** This in turn increases the immune response and the elimination of foreign pathogens and cellular waste products.

**Improves the lymph circulation** Accumulated toxins—often at the core of many health problems—are removed.

**Stimulates the hypothalamus** The hypothalamus controls the production of neurochemicals involved in processes such as sleep, mood, pain sensations, and blood pressure. FIR has been extensively used in this area.

### What conditions can FIR help treat?

FIR is being heralded as an exciting new treatment for a variety conditions:-

**Conditions affected by circulation** e.g. clogged capillary vessels hypertension arteriosclerosis (FIR increases blood flow by promoting dilation of capillaries); high blood pressure, low blood pressure, stress (it is thought that the improvement in blood circulation and the reduction in muscle spasms plays a role in this, haemorrhoids, varicose veins, Raynaud's disease (FIR assists with relief of pain and improved circulation of blood to the affected limb), chilblains (again, pain relief and improved blood circulation), peripheral vascular disease.

**Joints** e.g. rheumatoid arthritis (assists in reduction of swelling and inflammation by improving lymph flow.

**Pain relief** e.g. neuralgia headache (may lead to increased endorphin production, which reduces pain), menstrual cramps and pain (pain relief, improved flow of blood and reduction in cramps).

**Cardiovascular** e.g. arteriosclerosis (FIR improves blood flow reducing the risk of plaque being deposited on the artery walls).

**Weight Management** Improved circulation, elimination of toxins and improvement in metabolism is thought to contribute to weight loss as part of weight management programmes.

**Exercise and conditioning effect** A far infrared system can play a pivotal role in both weight control and cardiovascular conditioning, especially for those who are limited in their ability to carry out a full exercise programme, e.g. elderly or disabled; cardiovascular conditioning (NASA used FIR stimulation of cardiovascular function during long space flights); FIR is great for warming up before stretching or starting any vigorous activity.

**Collagen tissues** e.g. ligaments, joint capsules tendons. FIR increases the extensibility of collagen tissues, which improves the range of motion of scarred, thickened or contracted tissues.

**Inflammatory and oedema** e.g. Joint inflammation, gout.

**Soft tissue** FIR speeds up new and chronic soft tissue injuries.

**Cancer** e.g. cancer therapy, radiation sickness (relieves signs & symptoms), cancer pain (relieved in later stages of cancer).

**Immune system** Plays a role in fighting infection, e.g. in toe-and-finger-nail fungus (due to improved white blood cell function).

**Conditions associated with ageing** e.g. menopause, sequelae of strokes, leg ulcers, benign prostatic hypertrophy, osteoporosis (some scientists think that reducing excess acidity in the body through toxin elimination will improve bone density, Alzheimer's (the writer Terry Pratchett is currently undergoing a course of FIR treatment).

**Diseases of organs** e.g. duodenal ulcers, hepatitis, gastritis, cirrhosis of liver, bronchitis, Crohn’s disease , cystitis.

**Ear, nose, throat, conditions** e.g. sore throats , nose-bleeds, chronic middle-ear inflammation and infection, tinnitus.

**Respiratory** e.g. chest colds, bronchitis, pneumonia.

**Skin conditions** e.g. eczema, acne, psoriasis, chill-blains, leg and decubitus, burns, keloids.

**Brain** e.g. short-term memory improved, accelerated repair in brain contusions, cerebral haemorrhages; healing both speeds up and is significantly enhanced, migraines (as a result of improved blood flow to the brain).

**Body acidity** e.g. reduces acidity in the body (FIR causes fruit to ripen faster by reducing acidity).

**Nerves** e.g. peripheral neuropathy (FIR increases local microcirculation, helping to deliver oxygen and nutrients as well as reducing overstimulation of sensory nerves, pain, stiffness, and muscle spasm), Bell's palsy (again FIR assists with microcirculation).

**Musculoskeletal** e.g. lumbago, cramping , post-exercise muscle pain.

**FabRoc®—the FIR material from Exo2**

FabRoc® is a unique polymer that heats up when low voltage is passed through it and is powered by either rechargeable batteries, a mains power adaptor or from the accessory socket of a car or motorcycle. By regulating the voltage applied the heating element can be made to heat up to a pre-defined level to create a uniform area of heat with no hot spots.



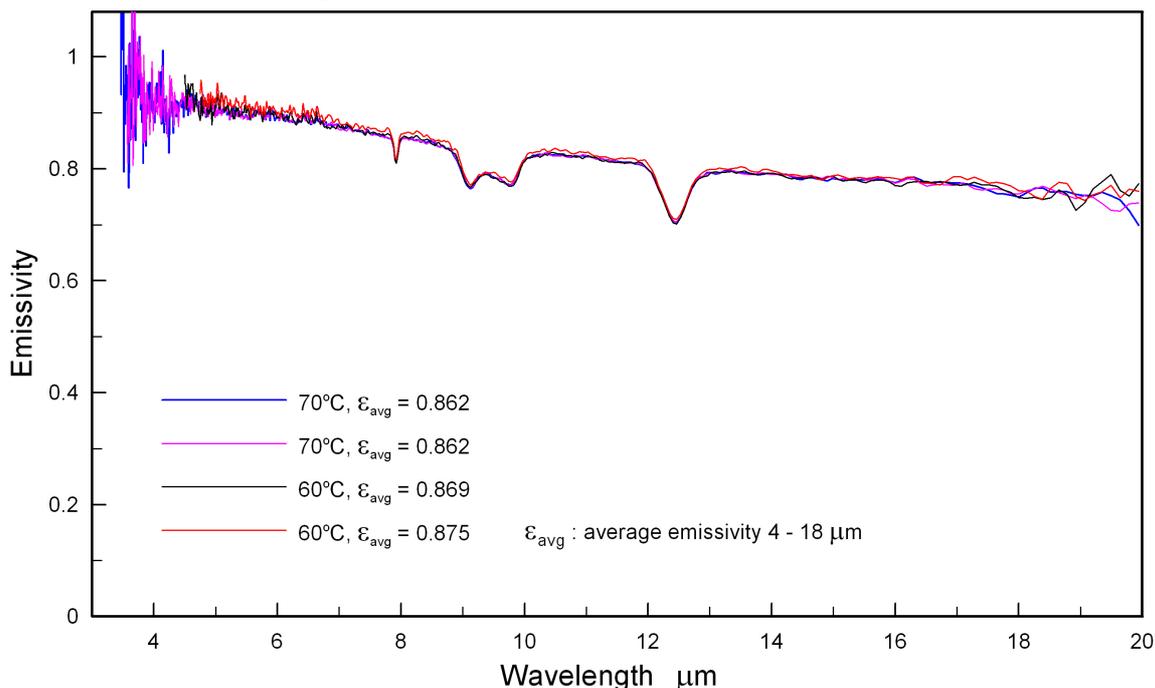
**Figure 2—Inventor Robin Caird and Managing Director James Laing**

Figure 1 shows the results of the extensive testing that FabRoc® has undergone. Where 1 is the ideal and 0 represents zero emissions, the emission rates for FabRoc® within the key FIR wavelength band of 4 to 18 microns average between 0.862 and 0.875, which is in the highly effective range.

*This means is that FabRoc® emits FIR waves within the range that provides most therapeutic benefit.*

**FabRoc® Products**

FabRoc® is a versatile material—it has a certain amount of ‘give’, it can be cut and shaped (it has the advantage over other heated materials in that there are no wires). The material can be set to heat to a certain temperature and then be self-regulating, or it can be designed so the user can control the temperature.



**Figure 1—Plot of FabRoc® FIR Emission Test Results**

FabRoc® can be incorporated into a wide range of products, from gloves to body warmers (see Case Study below).

### Case Study—Matt Atherton



Matt Atherton (22) was planning an evening out with friends one night in January. His plans were shattered, however, when he fell from a height, breaking his neck at C6 level with damage to the spinal cord. He was air-lifted to the Queen Elizabeth Spinal Injuries Unit in

the Southern General Hospital, Glasgow, and started on treatment right away. His right side began to show signs of movement quite early, but the left was much slower. This pattern continued after surgery, with the right side growing stronger, and the left responding only slowly to therapy. Matt explained, “The physio thinks that the left arm was stretched in the fall, which has damaged these nerves.”

It was at this point that James Laing of Exo2 heard of Matt and sent a pair of Exo2 Heated Mitts and a FabRoc® blanket.

After the first session with the mitts, Matt noted a very positive response. “I had the mitts on for a good hour”, he said. “And when I took them off I found I could open my hand, which I couldn’t do before”.

After only 4 months in hospital, Matt was allowed home. His left hand is still weak, but apart from that, he has full range of movement. After 8 months, he has even started back at work on a part-time basis.

He continues to wear the mitts, and finds the blanket very relaxing. Thanks to Exo2 and a very determined attitude, he is well on the road to full recovery.

### Conclusion

FIR for health is a relatively new concept in the West. However, as the understanding of this exciting new technology grows, more applications and products will be developed.

The potential market for these products is enormous. The ageing population means that an increasing number of people will be living with long-term conditions

in the future. People are becoming increasingly proactive in maintaining good health and of the benefits of self-management of minor conditions.

The expectation is that the acceptance of FIR products will continue to grow as their use spreads into mainstream. The window of opportunity for developing new products in this area is now.

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