



In-vivo testing for grip. CREDIT: VIBRAM

What's new in soling?

Vibram has enjoyed an outstanding reputation for high performance rubber soles in demanding applications ever since its first, and probably most famous, product—the Carrarmato climbing boot—sole was created in 1937. Its patented wedge-shaped lugs became the benchmark by which all other climbing boot soles were judged. Over the years more than twenty variants were developed using new rubber formulations. The development of the right compound to suit each demanding application remains the company's philosophy 75 years later.

Finding the right compound can often be time consuming as it requires three types of testing: physical property, 'in-vivo' (testing with humans) and field testing. The procedures of each of the lab and in-vivo tests are repeated with each different rubber formulation until the best compound for the sole's targeted end use is found. Further field tests are then run to validate data found

by the other test methods in the environments the sole is intended to be used in.

TESTING IS THE KEY

Lab testing involves subjecting the different compounds to a litany of tests to extrapolate a number of physical properties such as hardness, density, tensile strength, oil resistance, and abrasion resistance to name but a few. Physical properties yield the first glimpse into the potential advantages of any given compound.

In the *in-vivo* tests, outside environments are brought into a controlled lab setting and human testers are used to collect data. In one test method, testers use their body weight to pull on a rope attached to a load cell until the sole begins to slip. The forces can be used to calculate dynamic and static coefficients of friction on different materials, surfaces with varying degrees of roughness and surface contaminants depending on the intended end use.

Field testing is more complicated and involves recruiting teams of testers in the market segment the product is intended for. Tests usually involve comparing two different compounds with the tester wearing one of each compound. Frequently old compounds that are well understood are used as benchmarks and competitor products are added to the mix to truly see where the compound stands. A precise schedule and protocol helps to mitigate discrepancies. The resultant data are recorded and the test is filmed to ensure results are reliable.

MEGAGRIP

Vibram has always had rubber compounds that exhibit good wet grip and exceptional mechanical properties and others with exceptional wet grip and good mechanical properties but Vibram wanted to develop a 'hybrid' which had the best of both worlds: exceptional wet grip and exceptional durability. Vibram chemists have had

to work long and hard as they found there was always a compromise between the two extremes. Their in-depth research resulted in a compound that had great physical properties on paper and excellent results during field testing causing the company to name it Megagrip.

In order to reach full validation for such a revolutionary compound, field testing for Megagrip was even more strenuous than normal and involved teams of testers working across three continents. Vibram personnel worked with acknowledged experts to ensure consistency and prove the value of the enhanced grip coupled with the improved durability across a variety of performance segments. The result of the field testing was a new 'super rubber' soling compound for which the company has high hopes.

Available in soft 65/70 Shore A and firm 75/80 Shore A hardnesses, the compound is said to offer excellent grip on both wet and dry terrain while also maintaining a high level of durability. It is primarily aimed at consumers who frequently encounter wet surfaces while trekking as well as those who participate in extremely rugged activities such as canyoneering. Megagrip would, however, appear to be a compound that could be well used in a large number of soling applications for a wide consumer base.

TWO COLOUR EVA

Main Group produces a wide range of injection moulding machines of both static and rotary configurations, and covering a wide range of soling compounds. Its latest development is the E266 Evaluation series of static machines for two-colour EVA production. They are available in two, four, six or eight station units and can produce unit soles in one or two-colour, single colour in two densities or two colour and two densities. The company has long promoted EVA as a soling material due to its comfort/stability ratio, lightweight, rubbery touch and good thermal insulation properties.

Main Group claims some significant advantages can be obtained from the new machine including an absence of rejects caused by the long sprues and flashes that are sometimes a problem

in EVA moulding. This increases productivity as well as avoiding waste material and added cost. Productivity is also enhanced by an innovative mould cleaning system that is both fast and simple so that both operator workload and the time needed to clean a mould are substantially reduced.

A wide mounting plate allows two moulds to be used side-by-side, each of which is divided into three parts: top and bottom which are heated and a centre section which is cold. EVA is simultaneously injected into each mould cavity by the injectors which are mounted vertically, such that one fills the top cavity and the other the bottom. The moulds open and the centre sections move to the side out of the way. The top and bottom sections then close bringing the upper and lower elements of the sole together until cured. The moulds then open to allow extraction of the finished unit soles and the cycle to be repeated.

DESIGN FEATURES

The whole ethos of the machine has been centred on the use of mechanical solutions designed to save as much energy as possible. A good example is the method of mould closing where a special mechanism provides much faster movement than on previous machines thus not only saving time but also reducing the flow rate of oil used. E266 machines also feature an hydraulic pump unit and system where the dissipation of energy is very low indeed and this in turn has meant that,

as no refrigeration unit is required, further energy is saved.

The machines are specifically designed to produce unit soles, sandals, galoshes and boots. A long opening stroke which can reach 450 mm provides a large amount of space for access by the operator and for mould changing. Four independent injectors mounted vertically in pairs are used as this allows great flexibility in the use of colours during the moulding cycle. Each has its own management of pressures, flow rates and volumes, and is served by its own dedicated hydraulic pump. This allows the finest of adjustments to be made in order to produce mouldings of the very best quality and consistency.

The operator-machine interface is a touch screen PC positioned in a console located beside the machine while the main electrical panel is located on the back of the machine in order to minimise its footprint on the factory floor. The energy saving hydraulic system consists of five motor-pump groups having fixed delivery and a very high rate of efficiency controlled by a purpose-built inverter system providing completely independent management of flow rate and pressure. The unit itself is built into the machine structure and totally silent. Overall control of machine functions is by a PLC using simple to follow menus and supervised by software that draws on the company's long experience of EVA moulding. 



Main Group E266 EVALUATION moulding machine for two colour EVA.

CREDIT: MAIN GROUP TECHNOLOGIES