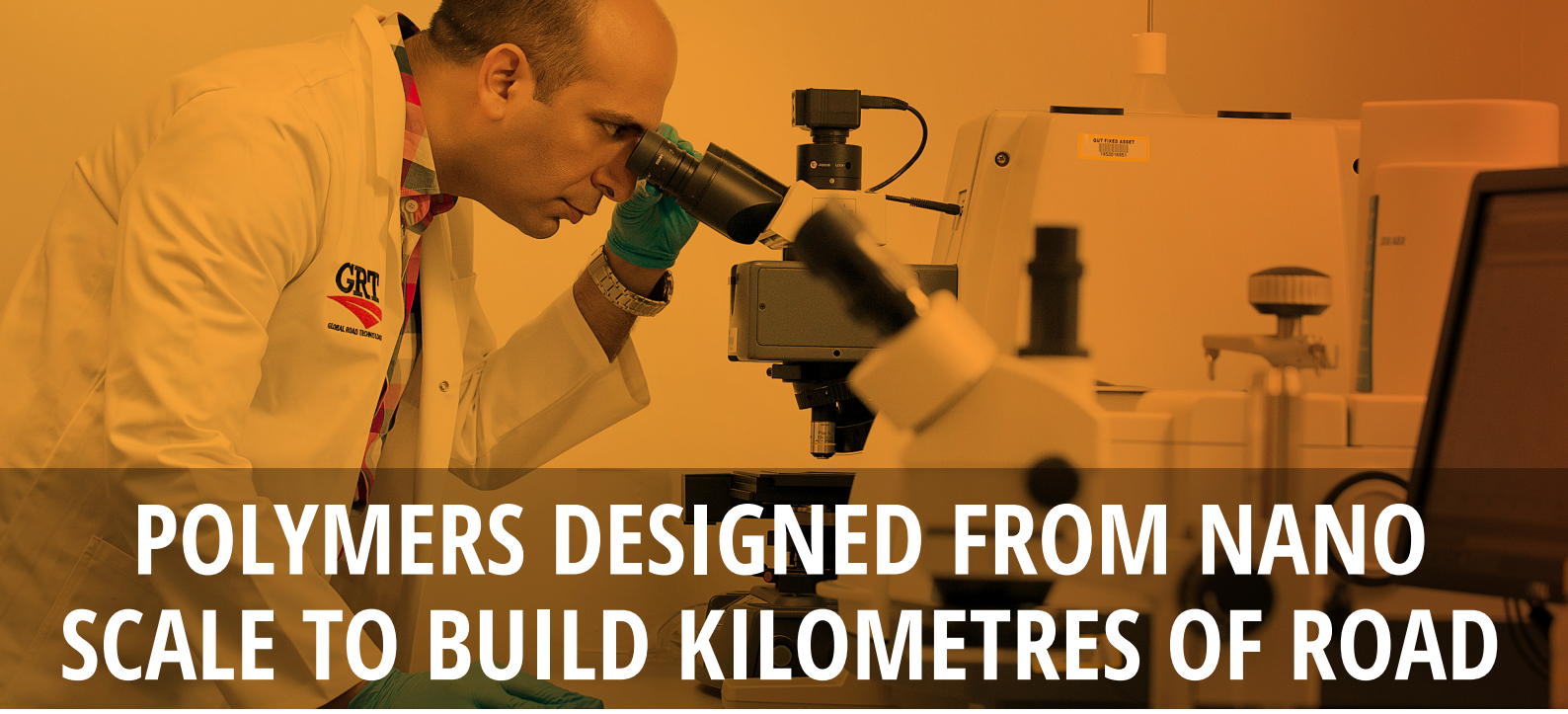


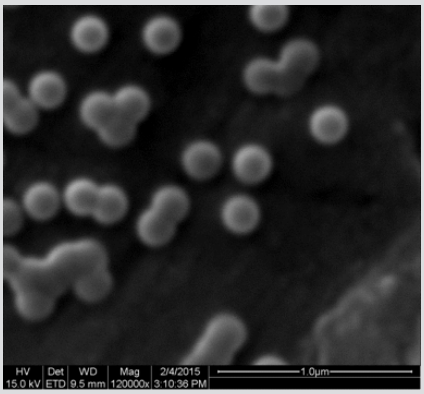
POLYMERS DESIGNED FROM NANO SCALE TO BUILD KILOMETRES OF ROAD

Research and development (R&D) is one of Global Road Technology's core strategic pillars. Our goal is to dominate through technical excellence.

Towards this, all business units and processes feed back into the R&D development team allowing GRT to have directed and mission critical R&D objectives. Our research team consists of experienced technologists and researchers in the fields of chemical engineering, geotechnical engineering, software engineering as well as civil engineering. They work closely with the sales and marketing teams who have regular contact with our customers. Our aim is to provide solutions to better satisfy our clients' needs.

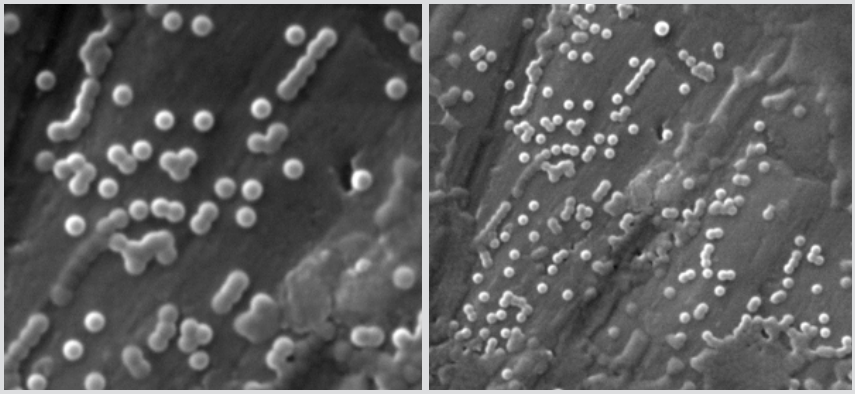
GRT scientists have designed new polymers for soil stabilisation and dust suppression. These polymers are smaller than 100 nanometre. This is 10-50 times smaller than the diameter of a strand of human hair. The resolution of light microscopes (traditional laboratory microscopes) is not high enough to image these particles but a Scanning Electron Microscope (SEM) can capture a black and white image of these particles. Figure 1 is an example image taken at magnification of 120,000

FIGURE 1



GRT POLYMER UNDER SCANNING ELECTRON MICROSCOPE

FIGURE 2



GRT NANO-POLYMERS SELF -ASSEMBLE TO FORM A POLYMERIC NETWORKS AND A EVENTUALLY A THINNER THAN 100 NANOMETER FILM

These Nano particles of soft polymers are dispersed in water and stabilised using special chemicals. After mixing with soil, particles agglomerate and form strings and networks that eventually turn into thin films. The scientists at GRT have managed to image this process using SEM as shown in Figure 2.

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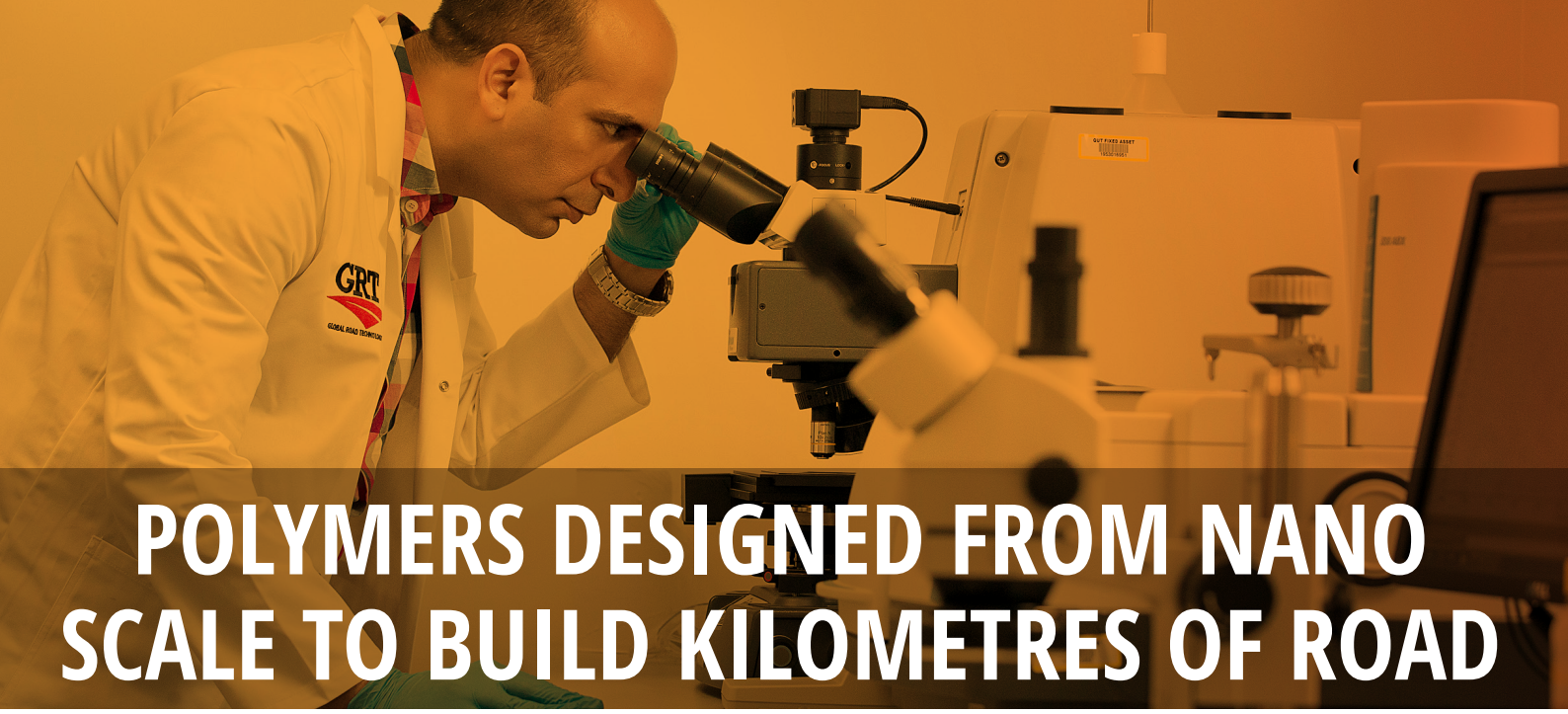
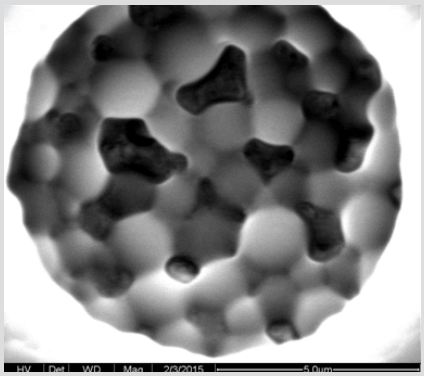


POLYMERS DESIGNED FROM NANO SCALE TO BUILD KILOMETRES OF ROAD

FIGURE 3



GRT POLYMERS PICTURED IN THE PROCESS OF FORMING A THIN FILM THAT ENCAPSULATES A MINERAL PARTICLES

Figure 3 shows an example of a mineral particle being encapsulated with polymer particles in the process of film formation. The thin film created by self-assembly of polymeric nanoparticles covers s oil particles and glues them together. These small particles are formulated to easily diffuse into soil; therefore, a small amount of polymer goes a long way and is enough to bind large quantities of soil.

GRT polymers have a solid content of about 50% and, depending on soil properties, 1-2% polymer is enough to achieve maximum strength in stabilised soil. These polymers are designed from molecular level to achieve long term desirable soil properties at low cost. times.

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