Pulsed Force Mode™ Applications

Race Car Tires

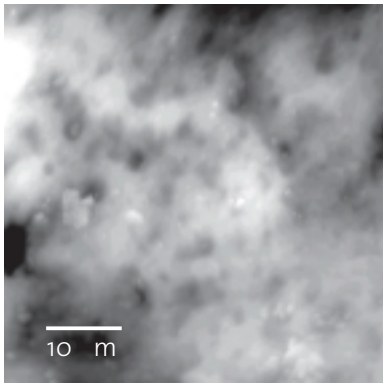
In no other sport is time as valuable as in motor sport. The development of racing tires is a process of continuous investigation and development. Tests are necessary permanently to make sure that state of the art products are available at the racetrack.

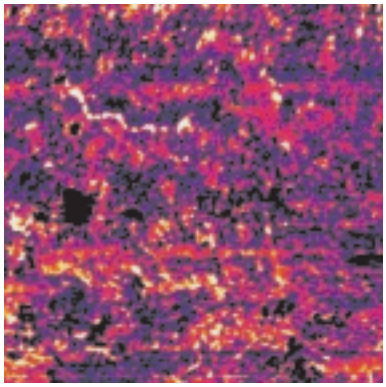
Already for decades Dunlop has been very active and successful in motor sports. Wherever motor sport is run the racing service of Dunlop isn´t far away. The exclusive partnership with the German race series DTM (Deutsche Tourenwagen Masters) continues in 2002.

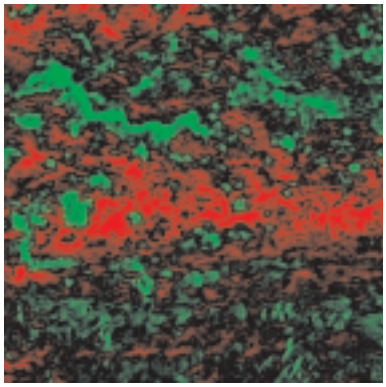
The Dunlop research and development laboratory combines Scanning Force Microscopy (SFM) with the unique Pulsed Force Mode (PFM) of WITec. With the Pulsed Force Mode, Dunlop examines the material properties of different composition of rubber on a micrometer and nanometer scale.

Scanning Force Microscopy images of the tread of a DTM racing tire obtained with Pulsed Force Mode.

The three pictures show the simultaneously recorded images of topography (top) adhesion (middle) and local stiffness (bottom). For measurement purposes the Scanning Force Microscope was set directly on the tire surface. Scan range: 50 x 50 micrometer. Dark areas correspond to low values of adhesion. In the middle image, dirt particles are clearly recognizable as black areas with a noticeably lower adhesion. In the stiffness image softer areas are red, harder areas are green. The PFM images show that the adhesion and stiffness clearly vary on the scale of one micron and below.







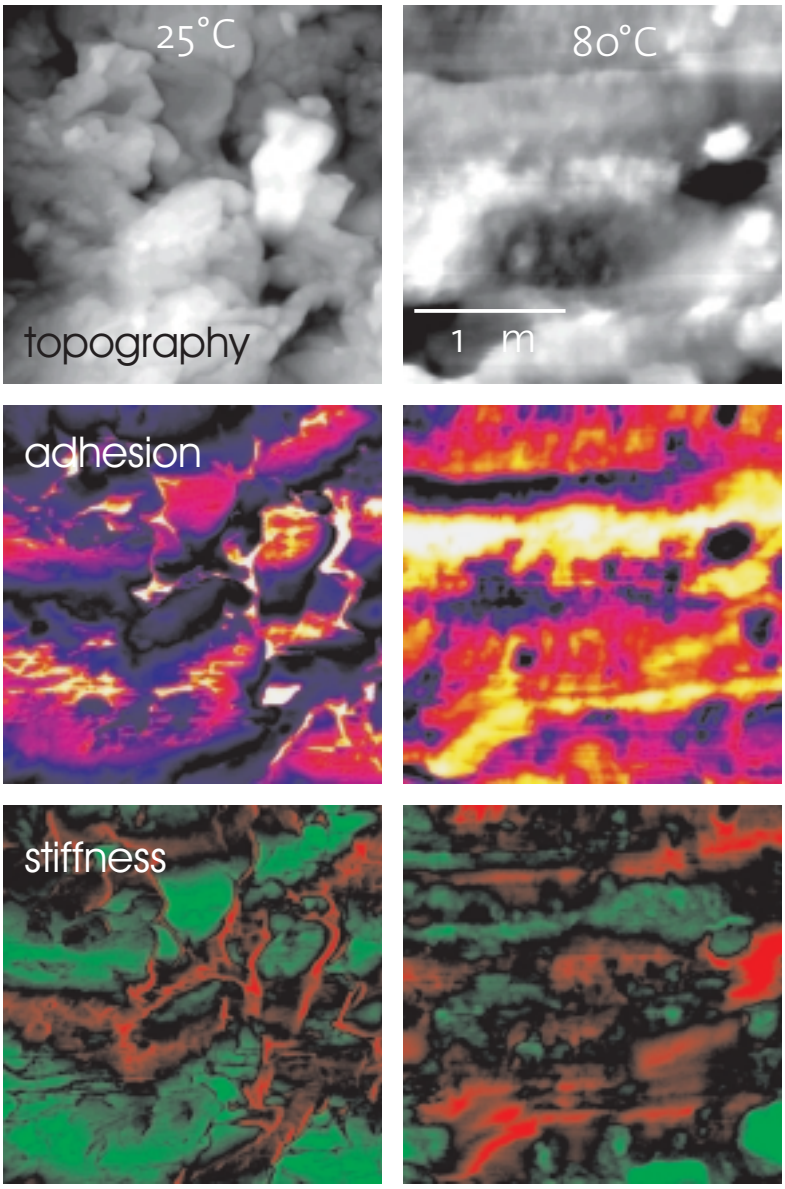
Pulsed Force Mode™ Applications
Race Car Tires

Treadless racing tires, so called slicks, have to be broken in before beeing used under full stess conditions. This is done by bringing the tires to the operating temperature for a brief period.

This phenomenon is shown on the right. There one can find Scanning Force Microscopy images of a racing tire rubber mixture acquired with the Pulsed Force Mode (scan range: 2,5 x 2,5 micrometer, topography above, adhesion in the middle and stiffness at the bottom).

The measurement shown on the left side was carried out at room temperature. The one on the right side at 80° C.

At 80°C, the adhesion is clearly higher (image is brighter). At the same time, the stiffness is clearly reduced (more red,less green)

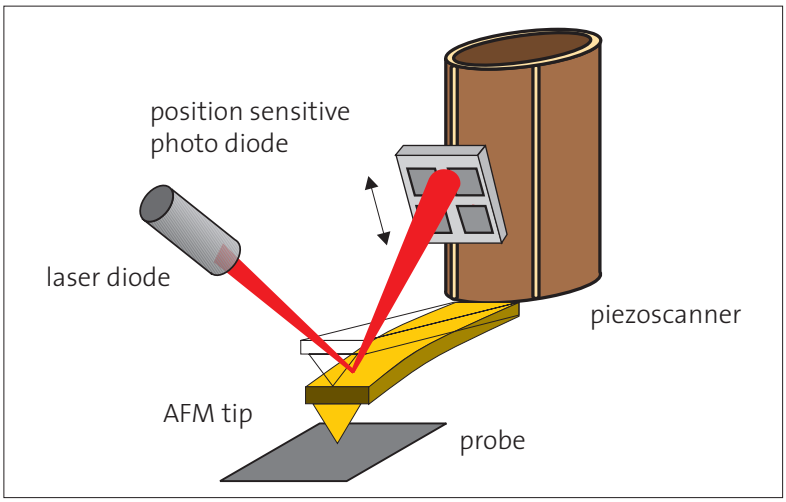


This work was kindly supprted by

DUNLOP

Working principle of a Scanning Force Microscope:

With a piezo scanner a fine tip fixed to a short cantilever is scanned over a sample. The acting force of the tip is determined through the bending of the cantilever and kept constant by a feedback loop.
The bending of the cantilever is determined by using a quadrant photodiode to measure the deflection of a laser beam.



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