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Usage of microscope method for detection of aggregate microtexture

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Abstract

A lot of methods have been developed for the detection of aggregate microtexture. The current development provides possibility to use microscopes that allow obtaining the three-dimensional high quality digital image of aggregate particle.
The stereomicroscope method is presented in the paper. An aggregate particle was scanned by a stereomicroscope and the 3-D image of investigated aggregate was created using the software Nis Elements D. Aggregate particle profiles were prepared from the 3D image by interactive measurement tool of the software. Using these profiles, statistical characteristics of aggregate particle, such as mean arithmetic deviation of a profile (*Ra*), root mean square (*Rq*), asymmetry of the profile (*Rsk*) and kurtosis - index of flattening of the profile (*Rku*) were determined.
The results of this method have shown variability of statistical characteristics among different profiles obtained from a single aggregate particle.

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Keywords: Microtexture, Aggregate, Microscope, Statistical characteristics.

1. Introduction

Microtexture is defined as configuration of particular peaks on the surface of aggregates particles and describes how the grains are smooth or rough. Microtexture is very considerable parameter in term of skid resistance and is mainly responsible for dry pavement friction at low speeds [1]. Microtexture is also necessary for assurance high

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friction values between tire and pavement [2]. Microtexture is characterized by wavelengths and the amplitudes in the range between 1μm – 0,5 mm [3].

Microtexture values are partially influenced by ability of aggregate particle to keep sharp edges and also rough surface which should resist smoothing of vehicles as long as possible. Thus, microtexture depends on the geometric properties of the aggregate particle (shape and size) and also on petrological and physical properties of aggregate particle.The more shaped surface of the particle and firmer and also sharper material of surface means that better and more lasting friction is expected. It is clear, that the possibilities of measuring microtexture and the knowledge of the roughness of aggregate particles are particularly important for the safety of road traffic.

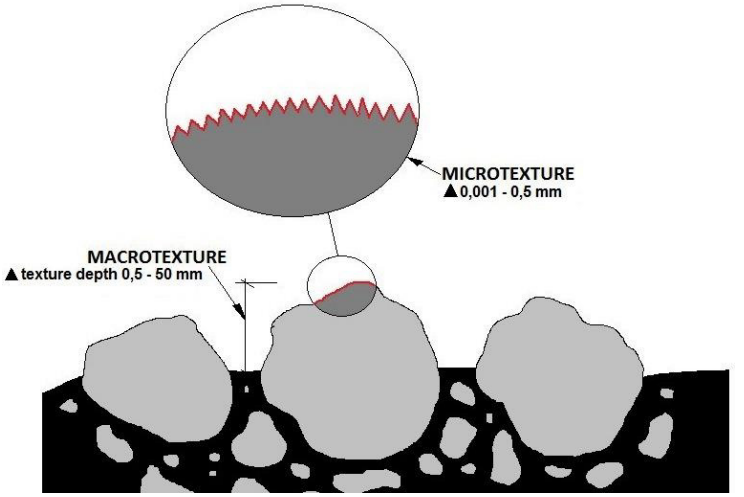

Fig. 1. Definition of microtexture.

A lot of methods have been developed for the detection of aggregate microtexture. These methods can be generally divided into manual measurements, detection of microtexture on the basis of comparison and digital image analysis methods. Manual methods and the methods on the basis of the comparison are easy to realize, but are considered as subjective and time consuming.

Determination of microtexture using the digital image analysis methods (DIAM methods) generally consist of the image acquisition, the image processing (image editing) and subsequent evaluation of the image by a various methods. The image analysis means conversion of the image on data. In the case of the digital image all these transformations and calculations are implemented in the pixel scene. In most cases evaluation is carried out by various mathematical algorithms in different computing programs. Many of the used algorithms are more complicated and very difficult to programming. Therefore this method requires considerable computer knowledge and longer processing time.

The current development of technique provides enhancement of methods via using microscopes or 3D laser scanners, which, in addition to obtaining a high-quality digital images of aggregate particles, allow obtaining three-dimensional images of aggregates particles.

2. Usage of microscope method for the detection of microtexture

It is possible to scan a particle of aggregate by a microscope (e.g. NIKON AZ 100). On the basis of the software Nis Elements D it is possible to achieve a 3-D view of investigated aggregate particle. The 3-D view is obtained from scanning of aggregate particle by cameras at different height levels. The aggregate particle is scanned on the microscope stage, which is vertically moved in micro steps by rotary knob. Then the software creates the final 3-D image from the particular images obtained during scanning.

After that, the EDF profile of investigated aggregate particle is determined in the software Nis Elements D. The acquired profile of aggregate is then expressed by x (y) and z coordinates (Fig. 2). This data file can be exported to