1994047

Intensity Online-Monitoring

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ABSTRACT

Up today, the ALMEN-method introduced in 1942, is the common way to measure intensities, mainly in the field of shotpeening. Many scientific contributions[1] demonstrate a certain skepticism, but also there are some improvements to be noted[2]. The here presented paper will inform on the base of a known technique[3] together with a not published study on gear-wheel intensity-monitoring, an investigation of an institute[4] and a recent contribution of an university[5].

KEYWORDS

Intensity measuring, intensity monitoring, Almen-technique

1 REVIEW

From 1990 onwards, the field-proven "Shot-Peening Monitor SPM-01"[3] was getting introduced to measure the impingement force within a particle stream. This measuring has to be combined with at least the air-pressure reading, preferably the flowrate-reading in addition. This 2 or 3 parameters will be processed by a small computing program, a simple task for the today's PC-possibilities.

As the ALMEN-principle is a worldwide appreciated and appropriated routine application, it might be difficult to establish really new devices and ideas as e.g. the above mentioned monitor SPM-01. On the basis of this contemplation, it seems to be more advisable to do modifications and improvments in ALMEN-philosophy as suggested in the here presented paper.

2 TEST SPECIMEN

The utilization of ALMEN-parameters should be the fundamental aim as far as possible. So it has to be remembered that the surface shape of an ALMEN-strip is exactly spherical:

$$R_{gauge,\ 0{,}609\ mm} = 209{,}392\ mm$$

(as max. admissible value equivalent to 0.025"), referring to the standard gauge outfit as described e.g. by SAE J442. But this measurement represents a line **offset** from the center of the virtual sphere. The real radius of an ALMEN-strip with 0,609 mm will be:

$$R_{eff,\ 0{,}609\ mm} = 209{,}54.\ mm$$

From the physical or processing point of view, nothing is against the idea to use ALMEN-theory related test specimens shaped **round.** Following, such pieces will be called ALMEN-Round. Also in this connection, one bad effect has always to be remembered: The area around the fixing screws for the rectangular strip is always distorted and the 4 pieces test points of the gauge are very closed to it. When using a round with a suggested diam of 18 mm+0/-0.2, this defect is nil. A test gauge for ALMEN-Rounds, similar to the original ALMEN-strip type, will indicate an arc height of 0,191 mm equivalent to the original 0,609 mm reading for rectangular strips.

3 MECHANICAL SETUP - STATIC MEASURING

The ALMEN-Round has to be placed on the sensor head and fixed with a swivel nut. For standardization reason, of course the geometry of all components must be defined. This set arrangement then will be processed by peening. Following, the round will be removed and the achieved spherical deformation measured. So this technique could replace the standard ALMEN-strip testing principle in many cases where it is difficult to place and install the rectangular strips.

4 MECHANICAL SETUP - ONLINE MONITORING

To measure the comparably small deflection of an ALMEN-Round is nowadays a rather simple job. The existing well proved sensor SPM-01 needs little modification only to be perfect for ALMEN-Round utilization. The originally force transmitting wear head and dome have to be replaced by the ALMEN-Round fixing device including the swivel nut. Equipped with a new test specimen, the device listed under the name SPM-02, has to be exposed to the peening process. Under the impact influence, the specimen surface will start to bend spherically and via a strain gauge arrangement the deviation can be monitored online. A curve known from the standard ALMEN-procedure can be made visible.

5 ADDITIONAL MONITORING POSSIBILITIES

In some cases, it is necessary to have a wireless transmission of intensity datas e.g. from a rotating workpiece. Here a VHF-signal transmission could be the answer. There are products on the market that fulfill all the specific requirements, only the price is on such a level that most common applications will be excluded. But nevertheless there are already detailed design studies available.

6 TESTS SPECIMEN SUPPLY SPECIFICATION

The ALMEN-Rounds must correspond with the comparable strips in respect of material, hardness, thickness, surface. In fact presently used ALMEN-Rounds are Laser-cuts out of Group I Premium Grade standard strips. A final inspection guarantees an equivalent accuracy not below the SAE J442 requirement.

7 ACCURACY

Investigations show an increased over-all accuracy achieved by the principle and procedure itself. The original ALMEN method bases on a strip fixation with 4 pcs screws. With increasing intensity, the square strip may buckle up and therefore adding at least one more parameter hard to specify. The round specimens are captured on full circumference on a tinny rim acting practically as flexible link. Also the gauge can be set to zero right from the beginning of the process. Additionally, the test specimen is under a preload (offset measurement compensated by the corresponding calibration disc), thus resulting in a rigid mechanical system.

8 ECONOMY

For lots of applications, the ALMEN-Round principle together with the online monitoring could cut costs. Equipment costs will be higher, on the other hand a considerably shorter manipulating time could be expected. With modern data recording, also this process can be more efficient. To determine the ALMEN-intensity of a machine setting in the conventional way, at least 4 pieces ALMEN-strips have to be used. With the SPM-02, the job is done in one single run much faster and the costs for a ALMEN-Round is even less then for a set of rectangular strips.

9 OUTLOOK

As with the described method a true online ALMEN-test procedure can be performed, the obtained signal is predestinated to be combined with a PC's capabilities. That means, that the ALMEN intensity for a given setting will be displayed as soon as the wellknown "knee" with the 10% increase-definition has been passed. A corresponding software is presently under development.

10 CONCLUSION

New ideas, new applications and new equipment might improve existing things. So it could be possible, that with the here described idea, some improvements could be made in the field of monitoring of shotpeening processes. Some experiences have already been gained and can be transferred to users involved in such tasks.

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