Aydiner, J Powder Metall Min 2014, 3:2
http://dx.doi.org/10.4172/2168-9806.1000e130

Powder Metallurgy & Mining

Editorial Open Access

Abrasive Water Jet Cutting of Granite

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Due to their unique characteristics such as excellent resistance to environmental effects and attractive decorative properties, granites has a special interest among natural stones. In recent years increasingly more efforts have been directed on machining of granites. Main driving factors for these efforts are the cost of machining process and the complex nature of the granites. In addition to the researches aiming at enhancing the operational conditions of the conventional processes such as circular sawing, the innovative methods and technologies have been experimented in granite machining.Among the innovative technologies developed recently, abrasive water jet (AWJ) cutting is being increasingly seen as a most promising machining method. AWJ cutting method has the ability to meet the required standards, while eliminating theadverse effects of the conventional methods. Some important advantages of this innovative method for mechanical machining of natural stones can be listed below:

1. Precise shape cutting can be achieved with a good surface finish;
2. AWJ cut kerf width is much smaller than that produced by traditional sawing technologies;
3. AWJ cutting systems can be easily integrated with existing CAD/CAM systems, thereby, greatly optimizing the shape cutting process;
4. The system produces no dust, thereby, significantly improving working conditions and benefiting the environment.

The performance of AWJ is controlled by a combination of many complex and interrelated factors, such as operating characteristics of the AWJ system and the material properties to be cut. Therefore, it is necessary to understand the cutting process and try to evaluate which properties affect the operation. Various researchers investigated the performance characteristics of AWJ systems [1-10].

Most research were focused on operational parameters such as standoff distance, water pressure, abrasive content and traverse sped. The material characteristics have attracted interests in recent years. Recently, some researches on machining of granite investigated the textural properties.

Karakurt et al. [10] conducted an experimental study on the cut depth of three granites. In their study, the experimentation was conducted on the basis of the Taguchi approach. The results showed that the traverse speed is the most significant parameter affecting the cut depth of the granite. This conclusion was also confirmed by the analysis of variance. Aydin et al. [9] investigated the surface quality of three granites cut by AWJ. The results indicated that the grain size of the rock-forming minerals and their boundaries have significant effects on the surface quality produced by AWJ. Hlava´cˇ et al. [7] conducted an experimental study to investigate the AWJ cutting quality. The experiments were performed on various samples of materials, including granite and marbles. The use of the declination angle for the prediction and control of the AWJ cutting quality was presented in their study. Agus et al. [2] analysed the influence of some properties of the granite on waterjet performance. They concluded that the mineral composition and porosity play important roles on the cutting mechanism for heterogeneous and mono-mineral rocks, respectively. Miranda et al. [3] investigated the relationship between the calcareous rock properties and material removal characteristics. The results revealed that the micro hardness (Vickers) of the stone plays a key role on the cut profile geometry. In addition to the stone hardness, porosity was also found to be a predominant parameter influencing the cutting mechanism. The effects of the processparameters of AWJ on the kerf angle of different granites were investigated by Aydin et al. [8]. A statistically designed experimental method was used to conduct the experiments. The most distinctive change was observed for the effect of the standoff distance and traverse speed in the study.

Currently, AWJ machining of granite has still been applied for special needs. Since it has limitations especially on cut depth.However, in the future more efforts capturing a wide range of factors affecting the process are expected to be performed. As a result the method may become an important alternative of conventional methods.

References

1. Kovacevic R (1992) Monitoring the depth of abrasive waterjet penetration. Int J Mach Tool Manuf 32: 725–736.
2. Agus M, Bortolussi A, Ciccu R, Kim WM, Manca PP (1993) The influence of rock properties on waterjet performance. In:Proceedings of the 7th American water jet conference, Seattle,Washington, USA, August, pp 427–442.
3. Miranda RM, Lousa P, Mouraz MAJ, Kim T (1993) Abrasive waterjet cutting of Portuguese marbles. In: Proceedings of the 7th American water jet conference, Seattle, Washington, USA, August, pp 443–457.
4. Wang J, Guo DM (2002) A predictive depth of penetration model for abrasive waterjet cutting of polymer matrix composites. J Mater Process Technol 121: 390–394.
5. Wang J (2007) Predictive depth of jet penetration models for abrasive waterjet cutting of alumina ceramics. Int J Mech Sci 49: 306–316.
6. Wang J (2009) A new model for predicting the depth of cut in abrasive waterjet contouring of alumina ceramics. J Mater Process Technol 209: 2314–2320.
7. Hlava´cˇ LM, Hlava´cˇova IM, Gembalova´ L, Kalicˇinsky´ J, Fabian S, et al. (2009) Experimental method for the investigation of the abrasive water jet cutting quality. J Mater Process Technol 209: 6190–6195.
8. Aydin G, Karakurt I, Aydiner K (2010) Investigation of effect of the process parameters on granite kerf angle in abrasive waterjet cutting. J Chambers Min Eng Turk 49: 17–26.
9. Aydin G, Karakurt I, Aydiner K (2011) An investigation on the surface roughness of the granite machined by abrasive waterjet. Bull Mater Sci 34: 985–992.
10. Karakurt I, Aydin G, Aydiner K (2012) An experimental study on the depth of cut of granite in abrasive waterjet cutting. Mater Manuf Process 27: 538–544.

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Received February 14, 2014; **Accepted** February 17, 2014, 2013; **Published** February 18, 2014

Citation: Aydiner K (2014) Abrasive Water Jet Cutting of Granite. J Powder Metall Min 3: e130. doi:10.4172/2168-9806.1000e130