



\* ... T

( // : // : )

SEM

:

(Drake, 1997)

(Doosthoseini, 2007)

(Withers & Loutfy, 2004)

(Chun et al., 2008 and Easter et al., 2001)

(Tabarsa, 1988 and Kargarfard *et al.*, 2003)

(Moghadassi et al., 2010)

CuO

(Layeghi et al., 2010)

, 2008 and Noorbakhsh & )

Ramtin .Kargarfard, 2006 and Kashanizaeh, 1988

(et al

Meng, 2009 and Xia .

%

(Chopkar et al., 2008)

(Sun & et al., 2005)

Ag<sub>2</sub>Al Al<sub>2</sub>Cu

/

%

( )

%

Pallmann pz8

%

ppm

(nm)	W/(m·K)	(°C)	(g/cm <sup>3</sup> )			
		/	/		Ag	

DIN68763  
DIN25363

SEM

) BS500

Black&Decker

(

( )

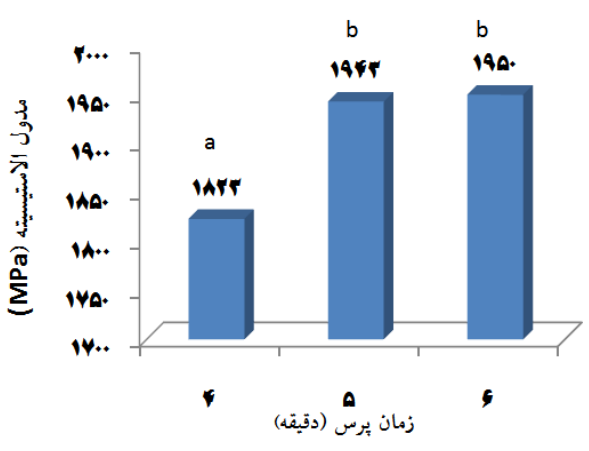
( )

- k

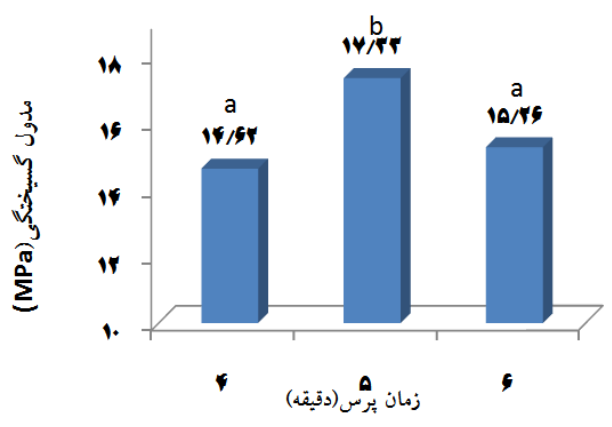
Burkle.LA160

...

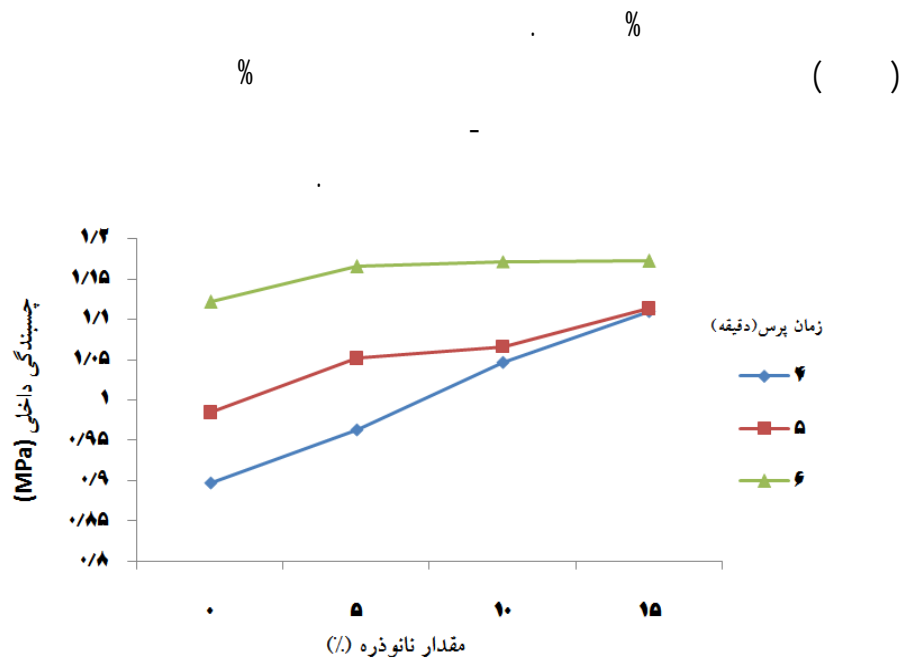
**	ns	**	ns	**	ns	ns	A
ns	**	**	*	**	*	**	B
ns	ns	*	ns	**	ns	ns	AB
/	/	/	/	/	/	/	%CV
				ns	*	**	



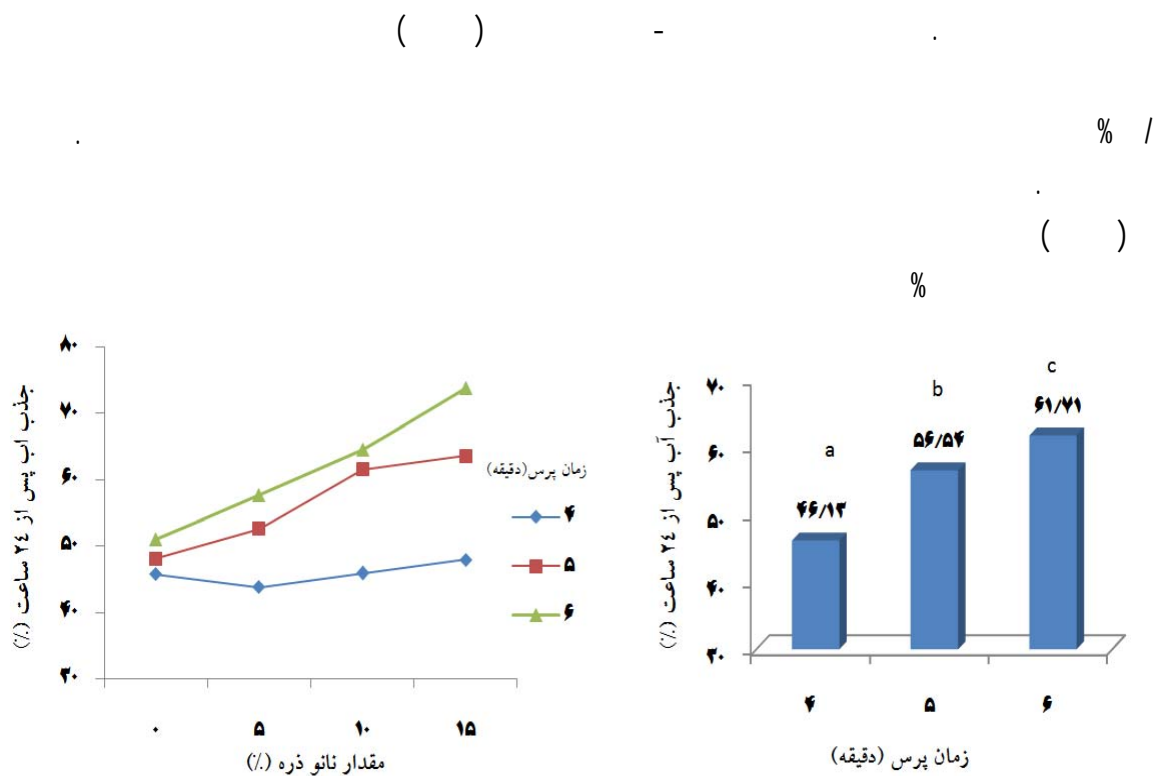
شکل ۲- اثر مستقل زمان پرس بر مدول الاستیسیته



شکل ۱- اثر مستقل زمان پرس بر مدول گسیختگی

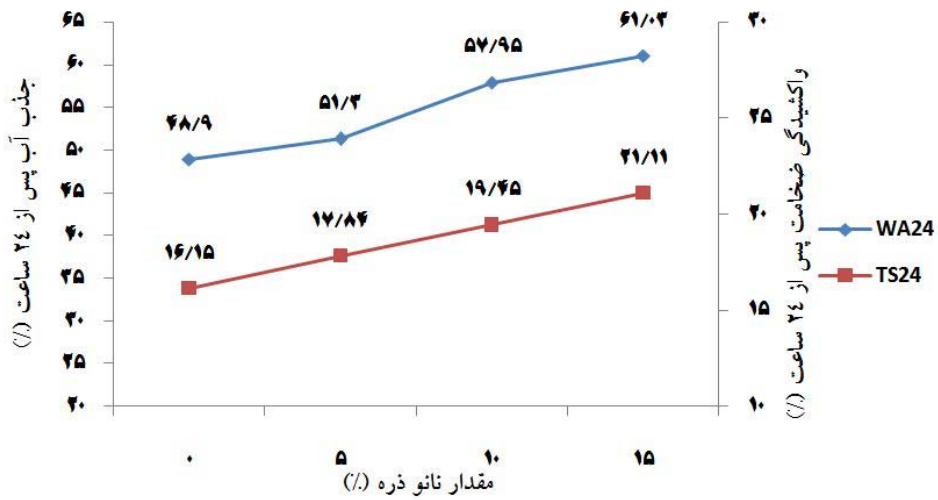


شکل ۳- اثر متقابل مقدار نانوذره و زمان پرس بر چسبندگی داخلی



شکل ۵- اثر متقابل مقدار نانوذره و زمان پرس بر جذب آب پس از ۲۴ ساعت

شکل ۴- اثر مستقل زمان پرس بر جذب آب پس از ۲۴ ساعت



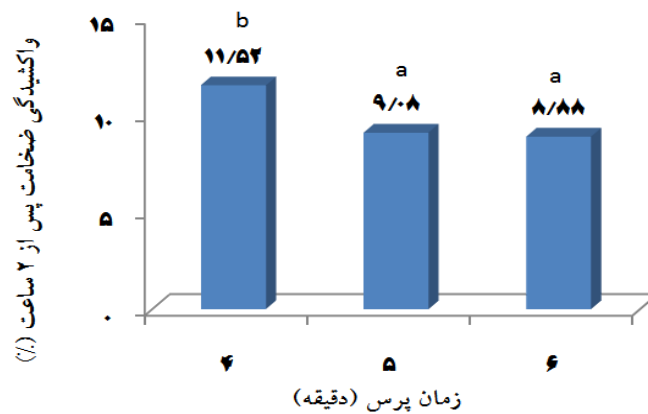
شکل ۶- اثر مستقل مقدار نانو ذرات نقره بر جذب آب و واکسیدگی ضخامت پس از ۲۴ ساعت

%

%

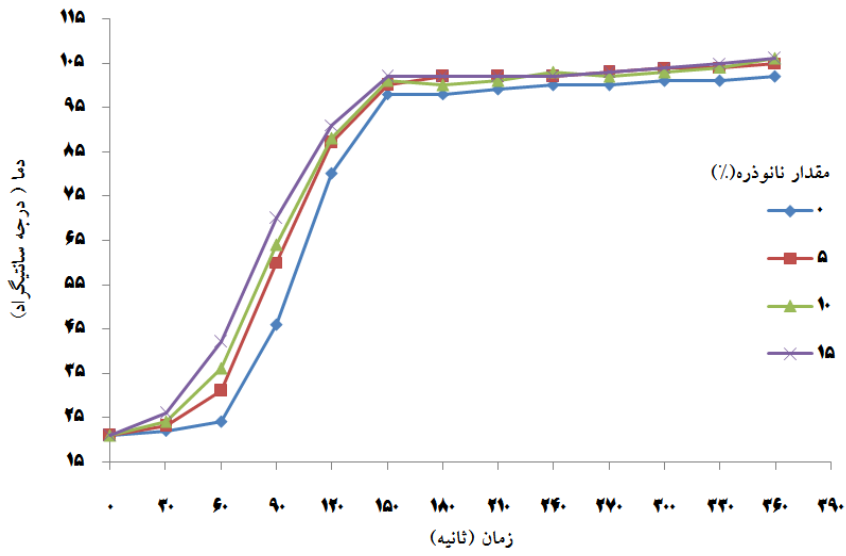
%

%



شکل ۷- اثر مستقل زمان پرس بر جذب آب پس از ۲ ساعت

( )



(B)

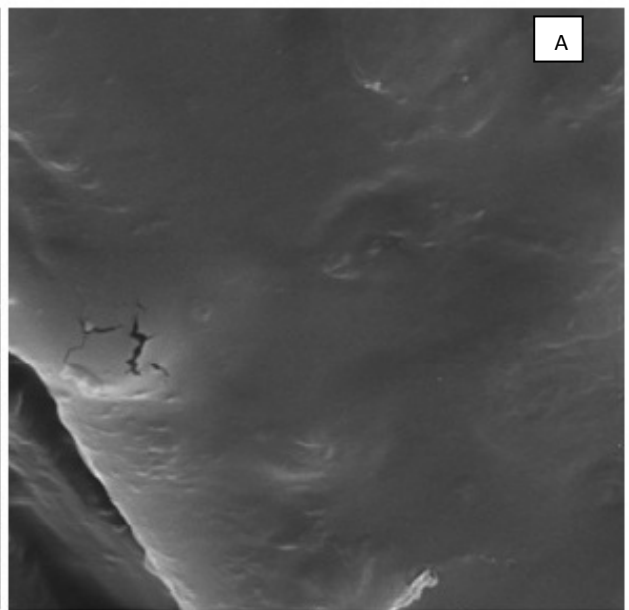
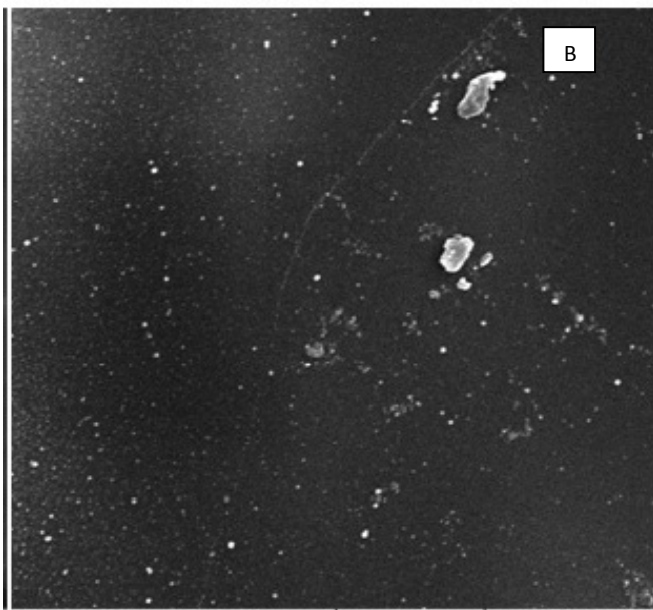
SEM

EDX

SEM

EDX

(A)

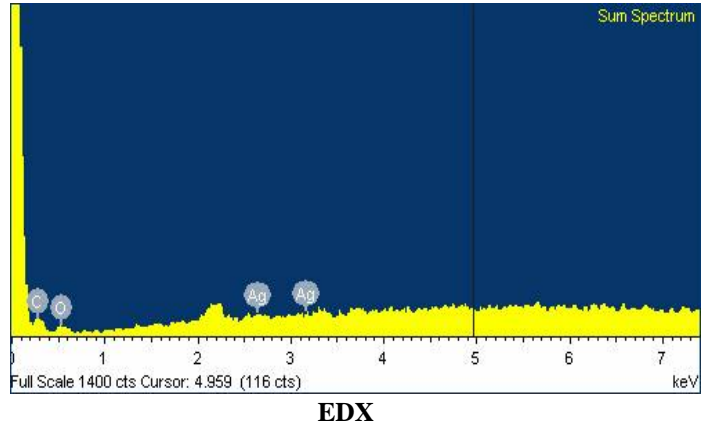


%

:B

:A

SEM



Tabarsa, )

.(1988

( )

.(Noorbakhsh & Kargarfard, 2006)

.(Chopkar et al., 2008)

.(Kashanizadeh, 1988)

Tabarsa, )

.(1988

Meng, 2009 )



( )

( )

SEM

( )

( )

## References

- Chopkar, M . Sudarshan, S. Das, P.K. and Mann, I. 2008. Effect of Particle Size on Thermal Conductivity of Nanofluid. Metallurgical and materials transations. 39(A):1535-1542.
- Chun, B. Kan, H. and Kim, S. 2008. Effect of alumina nanoparticles in the fluid on heat transfer in double-pipe heat exchanger system. Korean Journal of Chemical Engineering. 25(5): 966-971.
- Doosthoseini, K. 2007. Textbook of Wood compressed panels Production Technology and Application. 2<sup>nd</sup> Ed. Tehran university press, 708pp.
- Drake, P.A. 1997. The composite panel industry: a global market assessment. In: Proceedings of the 31st International Particleboard/Composite Materials Symposium, Washington State University, USA.
- Easter, J. Chio, S. and Li, S. 2001. Anomalously increased effective thermal conductivity of ethylenglycon-based nanofluid containing Cu nanoparticles. Applied physics letter. 78(6):7-20.
- Kashanizadeh, M.1988. Investigation of production four important factors on quality of particleboard made from veneer wastes (Beech). Master of science thesis. Tehran University. 164pp.
- Kargarfard, A. Doosthoseini, K. Jahanlatibari, A. and Hassanzadeh, A. 2003. Press time and temperature effect on heat transfer in particleboard production process. Research and Construction. 16: 56-65.
- Layeghi, M. Bina, M. and Hashemi. A. 2010. Investigation of Ag nanoparticles on physical and mechanical properties and thermal conductivity of particleboard. International conference of new technologies in wood and pares industry. Azad university of Chalos. May 18-19.
- Meng, F. and Sun, Z. 2009. A mechanism for enhanced hydrophilicity of silver nanoparticles modified TiO<sub>2</sub> thin films deposited by RF magnetron sputtering. Applied Surface Science. 255: 6715–6720.
- Moghadassi, A. Masoud hosseini, S. and Henneke, D.E. 2010. Effect of CuO Nanoparticles in Enhancing the Thermal Conductivities of Monoethylene Glycol and Paraffin Fluids. Industrial & Engineering Chemistry Research. 49: 1900–1904.
- Noorbakhsh, A. and Kargarfard, A. 2006. Effect of density and press time on properties of insulation poplar particleboard. Iran wood and paper researches. 21 (2): 115-122.
- Ramtin, A. Dadkhah, B. and doosthoseini, K. 2008. Investigation of press time and temperature on physical and mechanical properties of poplar OSB. Iran wood and paper Research. 23 (1):74-82.

...

---

- Tabarsa, T. (1988). Investigation of mat moisture content, temperature, press time on beech particleboard properties and polymerization of UF resin. Master of science thesis. Tehran University. 64 pp.
- Withers, R.O. Loutfy, J.C. 2004. Nano carbon materials for enhancing thermal transfer in fluids. Journal of Nanotechnology ([www.nano.ir](http://www.nano.ir)). 6 (123): 60-62.
- Xia, X.S. Cai, J. Hu,C. and Xei, U. 2006. Water Absorption Characteristics of Novel Cu/LDPE .Nanocomposite for Use in Intrauterine Devices. Wiley Periodicals, Inc. 345-352.

## Ag nanoparticles effects on heat transfer in press cycle and physical and mechanical properties of particleboard

M. Farajallahpour<sup>\*1</sup>, K. Doosthoseini<sup>2</sup>, M. Layeghi<sup>3</sup>, A. Kargarfard<sup>4</sup>

<sup>1</sup> Postgraduate of Master of Science, Department of Wood and Science & Technology, Faculty of Natural Resource, University of Tehran, I. R.Iran

<sup>2</sup> Professor, Department of Wood and Science & Technology, Faculty of Natural Resource, University of Tehran, I. R.Iran

<sup>3</sup> Assistant professor Department of Wood and Science & Technology, Faculty of Natural Resource, University of Tehran, I. R.Iran

<sup>4</sup> Faculty of Institute of Forests and Rangelands Research, I. R.Iran

(Received: 22 December 2010, Accepted: 06 June 2011)

### Abstract

In this paper, effect of Ag nanoparticles different contents on heat transfer during press cycle and physical and mechanical properties of particleboard was investigated. Mechanical strength including Internal Bonding (IB) and Bending Strength and physical properties including Water Absorption (WA) and Thickness Swelling (TS) after 2 and 24 hours soaking was determined. Heat transfer process from hot press plates to core layer of the mat during press time was recorded by thermocouples. Energy Dispersive X-Ray Spectroscopy (EDX) and Scanning Electron Microscopy (SEM) result prove presence and dispersion of nanoparticles in glue line well. Results indicate that Ag nanoparticles increase heat transfer to the core layer and cause IB improvement. But nanoparticles had negative effects on physical properties and increased WA and TS after 24 hour soaking. Heat transfer acceleration during hot press cycle is a way to reduce press time that results in efficiency increase by preserving essential strengths.

**Keywords:** Particleboard, Ag nanoparticles, Heat transfer, Press cycle, Physical and Mechanical Properties