OVER MOLDING

(INSERTS TECHNOLOGY & FUTURE TRENDS)

PREPARED BY SAM LEE (SAMLEE@HYROBOTS.COM) , ALICIA KIM (ALICIAKIM@HYROBOTS.COM)

HYROBOTICS CORP

5988 Mid Rivers Mall Dr. Saint Louis , MO 63304, USA, Tel : 1-636-578-6059 , 1-636-447-6440

Fax : 1-866-232-5594, Homepage : www.hyrobots.com,www.hyrobot.com (DATE : 7/17/2006)

1. What is over molding ?

- Inserting material in the mold before plastics injection molding
- Inserting Material : film, fastener, metal, leather etc

2. Why over molding required?

- **Function** : Better rigidity and strong resistance for torque breakage, vibration and shock compare to other method.
- **Design** : Better looking , more space availability to design and high quality finishing.
- **Productivity / Quality** : No Secondary operation required for Post Insert Process, Better quality Control with Vision System, Consistent Operation.

3. What kind of products require over molding ?

1) **Electronics : Cell phone**, Pager, Small electronics components
2) Automotive : Car bumper frame, Battery, Components
3) Appliance : Washing Machine Rotation Base, Refrigerator Glass plate.
4) Medical : Syringe and needle
5) Fashion : Leather, Metal insert over molding.

4. Why need fastener (Insert) in the plastics parts ?

- Most of plastics parts are required to assemble process to produce finished products. (Female Thread insert required to one side of products)
- Male screw will assemble two products as one with female threaded insert in plastics parts
- Front Case (Cover) , Back Case, Inside components which required assemble to cover.

5. How can the fastener (Insert) to be inserted in the mold ?

- After Molding (After finished products) : Post Insert Molding
  - Ultrasonic Insert (Vibration)
  - Heat Insert (Heat and Force)
- Before Molding : Pre-Insert Molding : Over Molding
  - **Insert Over molding : This is major topic for this reports**

6. Production Process Description.

- **Ultrasonic Insert Process**

Ultrasonic process converts electronics energy into high frequency mechanical vibration. In the production operation, an Insert is placed on the pre-drilled or pre-molded hole and the horn of the ultrasonic tool is pressed down on the insert. The horn transmits ultrasonic vibration to the metal insert and the friction from the vibration of the insert melts a thin film of resins at the metal plastics interface. Pressure from the ultrasonic tool forces the metal insert in to the hole unit it is completely inserted. When the ultrasonic toll is removed, the melted plastics next to the insert solidified and the insert is locked into place.

- **Heat or Thermal Insert (Heat and Force)**

Metal Insert is placed on the pilot of the tool, heated to proper temperature and pressed into a pre-drilled or pre molded hole in the plastics. The plastics adjacent to the metal insert melts to permit full seating of the insert. On removal of the tool, the plastics re-solidified in the area where melting and material flow occurred, locking the insert in the plastics.

- **Insert Over molding Automation (HYRobotics)**

Insert molding is an injection molding process whereby plastic is injected into a cavity and around an insert piece placed into the same cavity just prior to molding, thus the term insert molding.. The result of insert molding is a single piece with the insert encapsulated by the plastic. The insert can be made of metal or another plastic. Insert molding was initially developed to place threaded inserts in molded parts and to encapsulate the wire-plug connection on electrical cords. Insert molding is also used quite extensively in the manufacture of electronics and medical devices. Typical medical applications of insert molding include insert-molded needle hubs and luer fittings and bifurcations, as well as encapsulated electrical components and threaded fasteners. Additionally, over molded products benefit from excellent noise and vibration dampening.

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7. Pros and Cons of Insert Over Molding Automation.

Pros

1) Function (Mechanical Property)
   - More Mechanical resistance to shock and vibration
   - Pull & compression strength requirements of the insert
   - More Torque or axial forces resistance

2) Design.
   - Cosmetic design capability with less space insert holding area compare to ultrasonic and heat or Thermal Insert process).
   - The various selection of resin material. (Some material can not be used with Ultrasonic and Heat or Thermal Insert Process)

3) Productivity.
   - No Labor for Secondary Operation and Inspection with Visual System
   - Production Consistency with Robot
   - Quality Control with Visual inspection system

4) Cost Saving
   - No Ultrasonic and Heat or Thermal Insert Machine required.
   - Fast Cycle time especially for multi fastener inserts at one mold.
   - No Insert Orientation confusing with precision bowl feeder.
   - Insert Saving.

5) Other possibility
   - Better Leaking resistant (Humidity, Water, Oil etc.)

Cons

1) Learning Curve required for operation of machines
2) More Initial Investment required compare to Ultrasonic/Heat or Thermal Insert Process
3) Training Required for all operator.
4) Flexibility is limited : Need to change EOAT, Bowl feeder, Pickup Station for new production molds
5) Need to be considered in the design process of products.

8. Cost and Payback comparison

OPERATION AND COST COMPARISON FOR 1 MIILION PIECE OF INSERT MOLDING						
		Insert Molding Automation		Ultrasonic / Heat (General)		
Initial Investment	Take Out Robot (Full Servo)	$ 38,000		$25,000		
	Insert Supply Machine	$ 45,000				
	EOAT	$ 12,000				
	Vision System	$ 5,000				
	Ultrasonic Equipment x 2 units (15,000 / Unit)			$ 30,000		
	Base / Plate (Per new Mold)			$ 5,000		
	Sum of Initial Investment	**$ 100,000**		**$ 60,000**		
PRODUCTION COST : 4 Insert for One Cavity (8 Insert in Two Cavity Mold)						
	Molding Cycle Time ($ 50 / Machine Hr)	$194,000	3,880 hr (14 Sec)	$ 138,850	2,777 Hr 10 Seconds	
	Production Consistency Benefit with Robot	SAME		SAME		
	Post Insert Molding (5 Seconds / 1 Insert) x 8			11,111 hr	40 Seconds	
	Plant Operation Time : $5.00 / hr (Electricity, (Lighting), Water, Tax etc)	$ 58,200		$ 208,320		
	Sum of Production Cost	**$252,000**		**$ 347,170**	**More Time**	
LABOR COST						
	Labor : 8/hr x 3 Shift x 24 x 280 Days			$ 53,784		
	Labor Benefit : 15%			$ 8,067		
	Operation Manager	SAME		SAME		
	Sum of Labor Cost			**$ 61,800**	**Additional cost**	
QUALITY COST						
	Operation Rejection : 2 %					
	Ultrasonic or Heat Insert Reject : 8 %		0 %			
	Operator mistake (orientation, etc) : 3 %		0 %			
	Approximate Total cost of Rejection	$100,000	2% (20,000ea)	$ 650,000	13 %(130,000ea)	
	Sum of Quality Cost	**$ 100,000**		**$ 650,000**		
INSERT (FASTENER) COST DUE TO REJECTION						
	Insert Cost ($ 0.3 / Insert)	$ 24,000	20,000 x 4	$ 156,000	130,000 x 4	
		$ 24,000		**$ 156,000**		
TOTAL COST		**$ 476,000**		**$ 1,279,970**		
PIECE / PRICE (Not Including Resin / Energy)		**$ 0.476 / PIECE**		**$ 1.279 / PIECE**		

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" As you see over the long run, Insert over molding automation will produce the quality parts with less cost. The quality parts has more design capability with small fastener holding space. "

9. What we need for Over Molding Automation. ?

- Flexible Robot with the function for Insert Molding.
    1. HYRobotics offer various line of Robot for Insert Over Molding Automation.
- Bowl feeder to supply machine
    1. We have installed over Three hundreds tiny insert molding automation units
    2. Size : 3.0 ~2.0 mm Dia.
- Mechanism to transfer insert from Bowl feeder to Robot Pick up Station
    1. Air shooting Mechanism
        i. When insert is long enough for non-rotating in the mold.
    2. Plate Sliding Mechanism
        i. Fast and Reliable insert loading system without Scara Robot
    3. Scara Robot Mechanism
        i. Flexibility and More reliability
- End of Arm tooling

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7. Future Products Trends from HYRobotics

"Better slim design and simplicity , Meeting with real material and plastics."

Over 70% of consumers think real materials like real woods, real metals, designer fabric, and leathers will make electronics more stylish and visually appealing according to a national survey conducted in North America by Russell Research. In fact 8 in 10 said they would be more likely to purchase products with real materials. HYRobotics is developing real material insert molding automation for electronics products for consumers who wish to have limited edition products.

- Over molding (Insert) for better design, rigidity and productivity.
- Real Material Insert (Metal Frame, Leathers, Finished Wood, Designed Fabric) : Samples Design

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" HYRobotics research engineers keep working to find a better way to automate of new products for our customers to be competitive in the market"

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